TM 11-436

WAR DEPARTMENT TECHNICAL MANUAL

REPRODUCING EQUIPMENT MC-364-D

WAR DEPARTMENT • SEPTEMBER 1947

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DESTRUCTION NOTICE

WHY—To prevent the enemy from using or salvaging this equipment for his benefit.

WHEN—When ordered by your commander.

HOW—1. Smash—Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.

2. Cut—Use axes, handaxes, machetes.

3. Burn—Use gasoline, kerosene, oil, flame throwers, incendiary grenades.

4. Explosives—Use firearms, grenades, TNT.

5. Disposal—Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT

WHAT—1. Smash—Cases, panels, controls, loudspeakers, connectors, tubes, switches, terminal boards, and every other electrical or mechanical part, moving or fixed.

2. Cut—All wiring, cords, and cables.

3. Burn—All equipment cases, cords, cables, diagrams, and Technical Manuals.

4. Bend—All panels, cases, controls, and metal parts.

5. Bury or scatter—All the remaining pieces after destruction.

DESTROY EVERYTHING

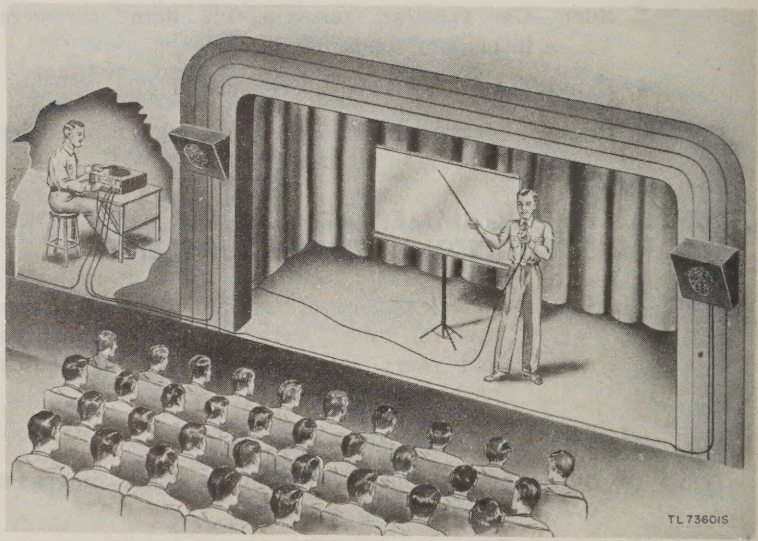


Figure 1. Reproducing Equipment MC–364–D, in use.

PART ONE
INTRODUCTION

Section. I. DESCRIPTION

1. General

Reproducing Equipment MC–364–D is a self-contained portable equipment which may be used as a means of reproducing sound recordings or as a public address system (fig. 1). The equipment consists principally of an amplifier-turntable unit and of loudspeakers and a microphone housed in a loudspeaker case.

2. Application

a. Reproducing Equipment MC–364–D is used to reproduce recorded disks or transcriptions 10, 12, or 16 inches in diameter which have been originally recorded laterally at 33⅓ or 78 revolutions per minute (rpm). The reproducing speed is adjustable to accommodate variations in line voltage or frequency (or both).

b. The equipment is used as a public address system when sound waves are picked up by the microphone supplied. The equipment is provided with channels for use either as a microphone pick-up or as a mixer for superimposing speech on a recorded background; the output in either case is fed to the loudspeakers.

c. The equipment can be used in conjunction with a film strip projector when sound recordings are to be used with the film strips. The projector is not provided with the reproducing equipment.

3. Technical Characteristics

Input voltage	115 or 230 volts (v), 50 to 60 cycles
Power output	10 watts (w).
Maximum gain, microphone input channel	130 decibels (db).
Frequency response:	
Microphone	+2 db from 70 to 9,000 cycles per second (cps).
Input channels	one low-impedance (50 ohms). MIC input channel; one high impedance phono (crystal) input channel.
Number of tubes	5 (two of which are twin-triodes).
Type of tubes	first two stages are Tube JAN–6SL7GT (with inverter in second stage); output stage is Tube

	JAN–6V6GT, two of which are used in push-pull; rectifier tube is Tube JAN–5Y3GT.
Output transformer impedance	3.5 ohms.
Microphone:	
Type	dynamic, moving coil.
Impedance	50 ohms.
Loudspeakers:	
Type	10-inch, dynamic, permanent magnet.
Power rating	6 w (peak).
Voice-coil impedance	3.5 ohms.
Phono motor:	
Type	single-phase, shaded-pole, a-c, induction.
Speeds	33⅓ and 78 revolutions per minute (rpm).
Speed control	governor - operated by accessible lever.
Reproducer head	crystal type, high temperature, cutoff frequency of 4,000 cycles, removable needle.

4. Table of Components (fig. 2)

Component	Required number	Height (in.)	Depth (in.)	Length	Weight (lb.)
Amplifier-turntable unit complete with tubes, fuse, and pilot lamp	1	11	19⅜	19 in.	46
Stroboscope assembly:					
Disk, stroboscope	1		6¼ diam		
Lamp	1		¼ diam	1 1/16 in.	
Loudspeaker unit:		16¼	14½	13⅞ in.	30
Power cable	1			25 ft.	
Loudspeaker cable	2			50 ft.	
Microphone cord	1			25 ft.	
Loudspeaker	2				
Microphone	1				
Set of running spare parts:					
Tube JAN–6SL7GT	1				
Tube JAN–6V6GT	1				
Tube JAN–5Y3GT	1				
Needle	1				
Fuse	5				
Lamp, incandescent	1				

Note. This list is for general information only. See appropriate publications for information pertaining to requisition of spare parts.

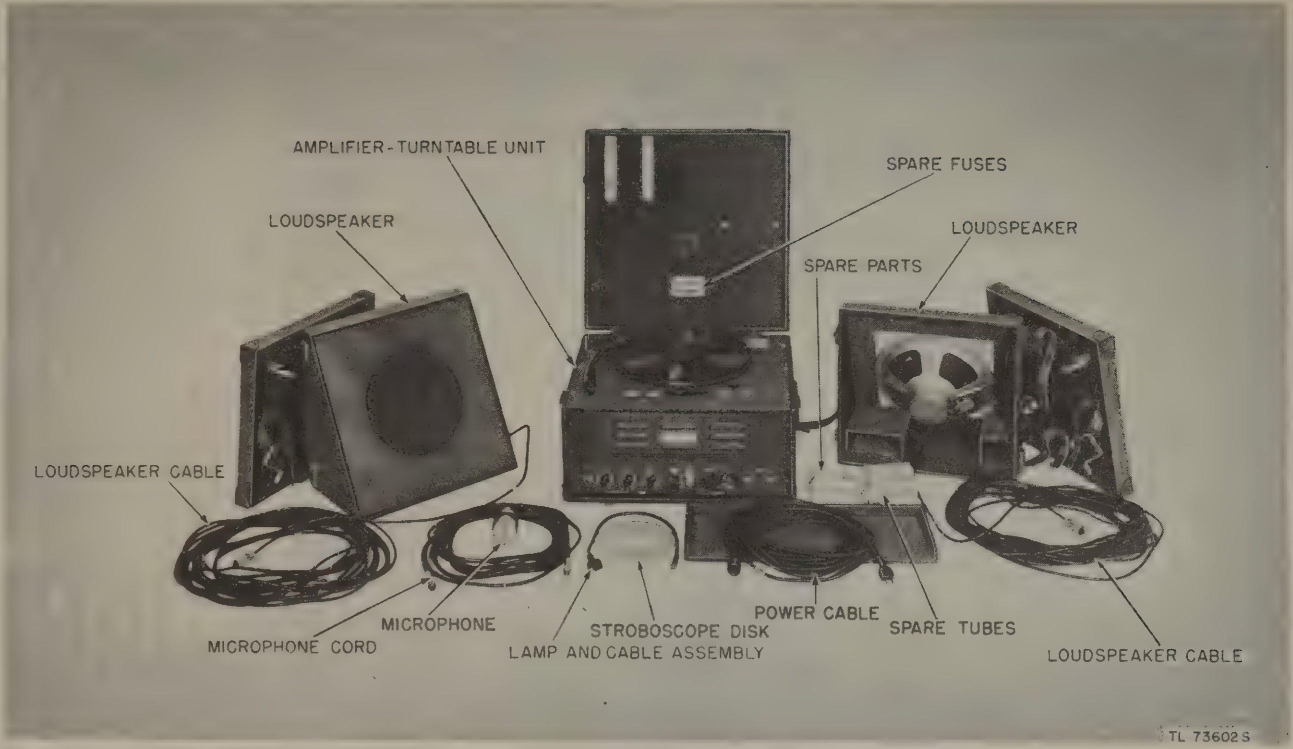


Figure 2. Reproducing Equipment MC–364–D, component parts.

5. Packaging Data

a. The two cases in which Reproducing Equipment MC–364–D is housed (fig. 3) are strapped side-by-side on a wooden board. They are then sealed by a series of layers, first by a layer of corrugated paper, then by a layer of metal foil, by another layer of corrugated paper, and finally by a layer of asphaltum paper. This entire assembly is fitted tightly into a wooden box. The wooden box is then nailed and finally bound by three metal bands (fig. 10). The packaged reproducing equipment is now ready for export.

b. The outside dimensions of the packaged equipment are 37 inches long by 22 inches wide by 16 inches high.

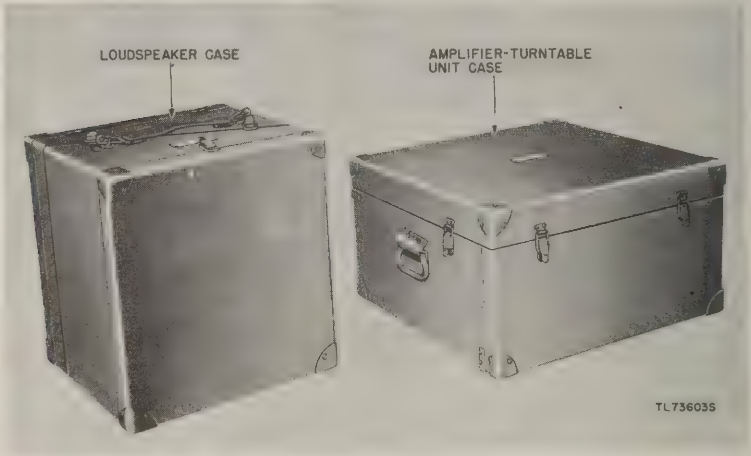


Figure 3. Cases for amplifier-turntable and loudspeaker units.

6. Description of Major Components

a. Amplifier-turntable Unit (fig. 4). The amplifier-turntable unit is housed in an olive-drab wooden case and consists of the amplifier chassis, control panel, turntable drive motor and turntable, reproducer arm with pick-up cartridge, and stroboscope assembly.

(1) *Amplifier-turntable unit case.* This plywood table-type case is reinforced with steel corners and is provided with folding-type carrying handles. The top cover of the case is latched by draw pull catches and is hinged so that it can be opened or removed to provide access to the turntable, its controls, and the pick-up arm. The front section can also be unhinged to provide access to the control panel and the tube access panel.

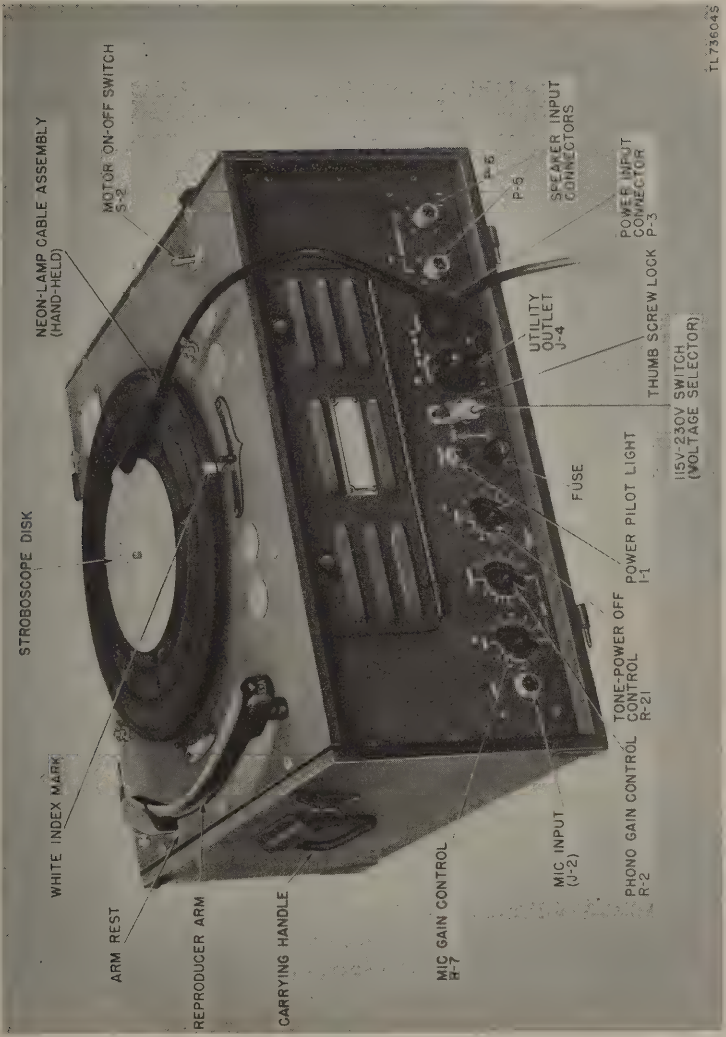


Figure 4. Amplifier-turntable unit.

(2) *Turntable and turntable drive motor.* (*a*) The turntable, which is 12 inches in diameter and flock-coated, is mounted on the drive motor shaft which is centrally located on the deck panel, slightly to the rear of the case (fig. 5). The turntable is supported by a metal washer that rests on the drive shaft pin; the washer is provided with grooves that fit the pin. A rubber washer (fig. 3) is used between the turntable and metal washer to absorb

vibrations. A modified C spring washer locks the turntable in place on the shaft when the amplifier unit is in transit.

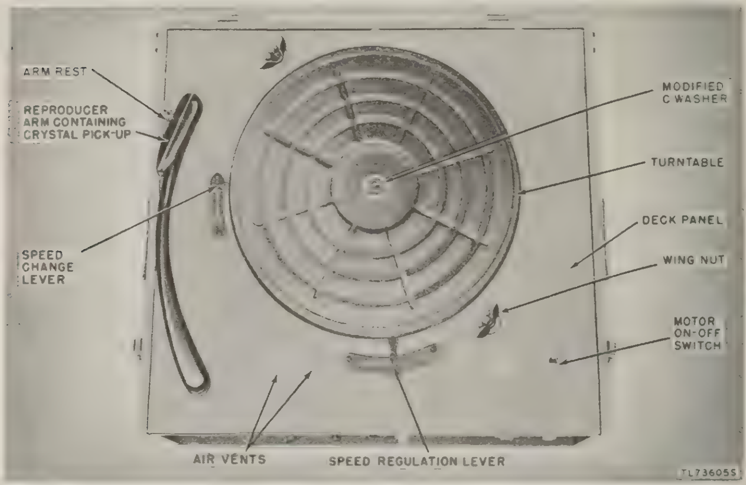


Figure 5. Turntable, top view.

(*b*) The phono motor is centrally located below the deck panel (fig. 6) and supplies the necessary power to drive the turntable. It is a dual-speed, self-starting, induction-type motor which drives the vertical shaft through a system of gears. Two speed control levers protrude from under the turntable. The speed change lever at the left of the turntable actuates the gear mechanism in the gearbox of the phono motor and is used to select 33⅓ or 78 rpm turntable speed. The speed regulation lever located near the front of the deck panel adjusts the governor position on the phono-motor shaft and increases or decreases the selected speed within required tolerance. The governor control is provided with maximum and minimum stops. The four holes covered by perforated plates at the front of the deck panel provide ventilation for the motor and amplifier.

(*c*) A U-shaped yoke (fig. 6) is provided to immobilize the motor and to prevent vibration during transportation. The yoke is tightened in place by wingnuts.

(*d*) The reproducer arm is mounted on the deck panel at the left of the turntable and is provided with an arm rest. The arm retains the crystal pick-up and is 12 inches long by 1 inch wide by 1³⁄₁₆ inch high. It is provided with a thumbscrew lock at the front of the arm to clamp it in position on the arm rest during transit. The reproducer arm will travel in an arc to accommodate 10-, 12-, and 16-inch records. The reproducer head is the crystal type and is held in place by two fillister screws.

(3) *Control panel.* The control panel is exposed when the front section of the amplifier-turntable housing case is removed (*a*(1) above). The various controls and connectors are located on the control panel (fig. 4) in the following order: MIC input connector, MIC GAIN control, PHONO GAIN control, TONE-POWER OFF switch and control, fuse holder, POWER pilot light indicator, 230V–115V voltage-selector switch (with locking thumbscrew), utility OUTLET connector power INPUT connector, and two SPEAKER output receptacles. A small door located above these controls is provided for easy access to the vacuum tubes (fig. 12). The door is hinged at the center of the control panel and is held closed by two thumb knobs; it is louvered for ventilation.

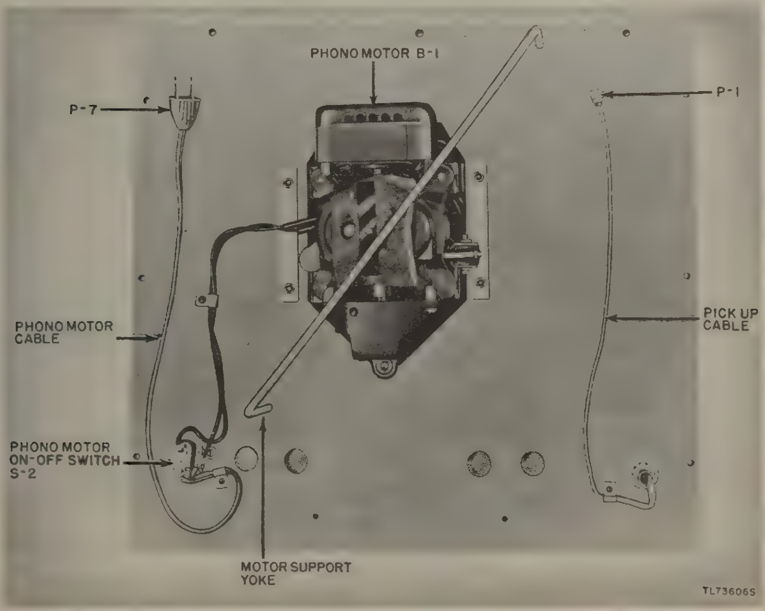


Figure 6. Turntable unit, bottom view.

(4) *Amplifier chassis.* The amplifier is a five-tube, resistance-coupled amplifier, including the power supply. The amplifier chassis is mounted on the floor of the amplifier-turntable unit case and is located beneath the deck panel. All tubes, transformers, power

filter capacitors, plate bypass capacitors, power connector for the phono motor, and hum control are located on the top of the metal amplifier chassis (fig. 18). The underneath of the chassis is provided with two panels: one panel supports resistors for the bleeder and filter system of the power supply; the other supports resistors and capacitors for the coupling and phase inverter networks (fig. 19). The amplifier chassis with its control panel is readily removable from the case as a unit.

(5) *Stroboscope assembly* (fig. 2). The stroboscope assembly consists of a ¼-watt neon lamp and a stroboscope disk. The lamp is operated from the utility outlet (fig. 11) and is used in conjunction with the stroboscope disk to adjust for the proper turntable speed. The disk is 6¼ inches in diameter and contains four rings with alternate black and white segments which, when moving, give successive instantaneous views of a moving object. The innermost and its adjacent ring are used with power input frequencies of 50 and 60 cycles, respectively, when synchronizing 78 rpm; the outermost ring and its inner adjacent ring are used with power input frequencies of 60 and 50 cycles respectively when synchronizing 33⅓ rpm. The lamp is a 105- to 125-volt lamp and is 1¹⁄₁₆ inches long and ¼ inch in diameter. The stroboscope

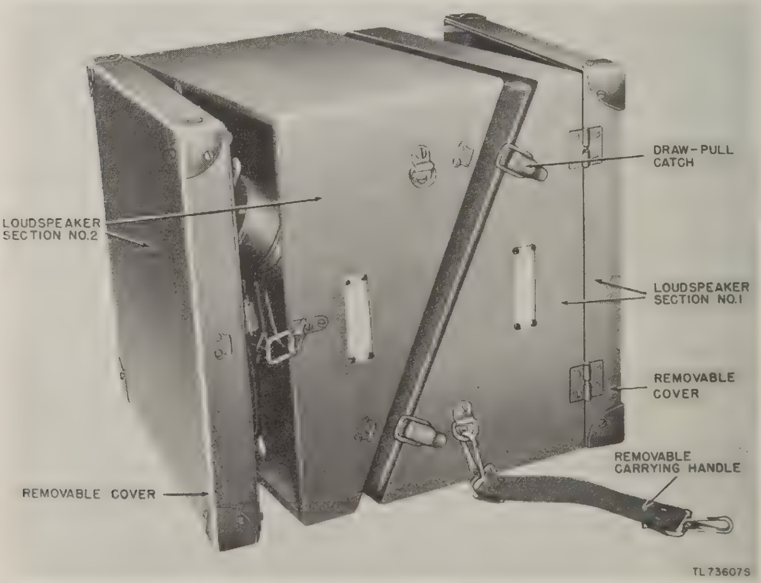


Figure 7. Loudspeaker case assembly.

assembly is located in the top cover of the amplifier unit case; the lamp is protected by a wooden sheath.

b. Loudspeaker Unit (figs. 7 and 8). The speaker unit consists of a loudspeaker case assembly, two 10-inch permanent-magnet loudspeakers, the power cable, microphone, microphone cord, loudspeaker cables, and spare parts.

(1) *Loudspeaker case assembly* (fig. 7). The loudspeaker case assembly is constructed of olive-drab plywood, reinforced at the corners, and houses all the components of the speaker unit. The case consists of two sections. Each section is provided with a sloping front and a rear removable cover. Each removable cover is hinged and latched to the rear of its section and provides access to the cord and cables, loudspeaker, and spare parts compartment. The two case sections are latched together sloping fronts facing each other, by means of draw pull catches. When completely assembled, the case can be hand-carried by means of a removable cotton-webbed carrying handle, which is provided.

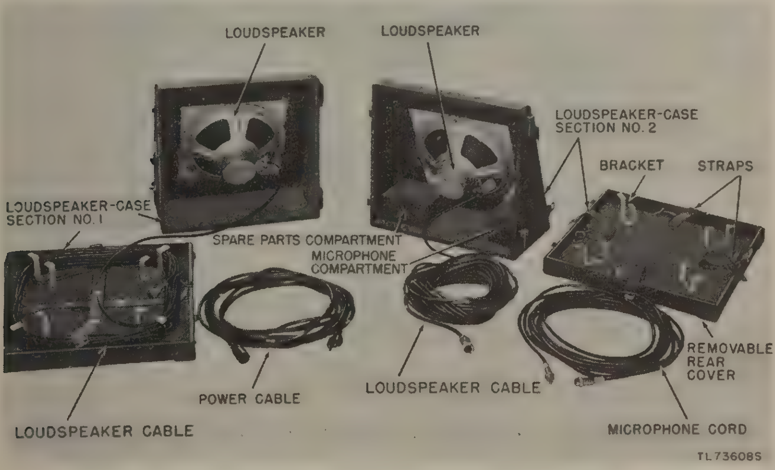


Figure 8. Loudspeaker case assembly, disassembled and showing loudspeakers and cables.

(*a*) The rear cover of loudspeaker case section No. 1 contains a loudspeaker cable and the power cable. The cables are wound around brackets and are prevented from unwinding by four straps.

(*b*) The rear cover of loudspeaker case section No. 2 contains a loudspeaker cable and the microphone cord. The cord and cable are wound around brackets and are prevented from unwinding by four straps. The base of section No. 2 is provided with two small felt-lined compartments in which the microphone and spare parts are stored.

(2) *Loudspeakers.* Reproducing Equipment MC–364–D is provided with two 10-inch, permanent-magnet, dynamic loudspeakers. Each loudspeaker is housed in one of the two loudspeaker case sections ((1) above). The loudspeaker is mounted by four screws on the back of the section's sloping front which serves as a baffle board; the loudspeaker cone is protected by a flock-coated, wire-meshed grill. One end of the loudspeaker cable ((1) (*b*) above) is permanently connected and clamped to the loudspeaker frame. The broad base of the loudspeaker housing provides an excellent table or platform mounting for the loudspeaker.

(3) *Microphone assembly* (fig. 9). The microphone assembly consists of a microphone and an associated microphone cord.

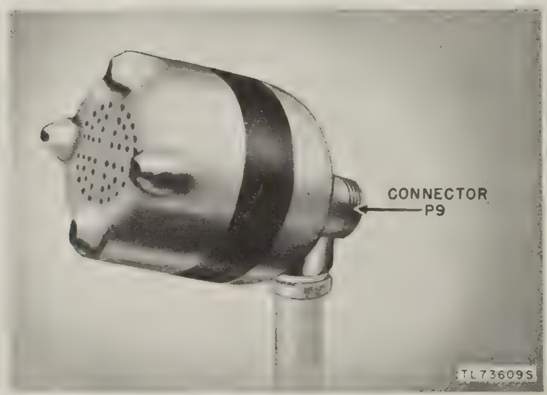


Figure 9. Microphone.

(*a*) *Microphone.* The microphone is of the dynamic moving-coil type. The microphone is provided with a male connector and is threaded to accommodate the ring nut of the female connector at one end of the microphone cord. The base of the microphone is also threaded so that it can be mounted on a microphone stand if desired.

(*b*) *Microphone cord.* The microphone cord is a shielded, two-conductor cord, 25 feet long. One end of the cord is provided with a male connector and the other end is provided with a female connector. The cord is used to connect the microphone to the amplifier when the equipment is to be used as a public address system.

(4) *Power cable* (fig. 8). The power cable is a 25-foot, rubber-jacketed, two-conductor cable which is provided at one end with a two-contact male connector and at the other end with a female connector. The cable is used to connect the equipment to an alternating-current (a-c) power source.

(5) *Loudspeaker cables* (fig. 8). Reproducing Equipment MC–364–D is provided with two identical loudspeaker cables. Each cable is 50 feet long and is composed of two conductors which are rubber-insulated and jacketed. One end of each of the loudspeaker cables is wired and clamped directly to its associated loudspeaker; the other end is provided with a two-contact female connector. The cables connect the loudspeakers to the SPEAKER output connectors on the amplifier-turntable unit.

Section II. INSTALLATION

7. Siting

a. Locate the amplifier-turntable unit where there is ample room to operate the amplifier controls and the turntable. Be sure that the microphone can be used conveniently. Also, in applications where one operator uses the microphone while a second manipulates the controls, the microphone operator should be easily and clearly seen by the control operator.

b. Mount the loudspeakers to the left and right of the amplifier-turntable unit. When the equipment is used as a public address system, acoustical feedback or howling (par. 13*b*(1)(*c*)) may occur; to reduce feedback, reposition the loudspeakers.

8. Uncrating, Unpacking, and Checking (fig. 10)

Use care when uncrating and unpacking Reproducing Equipment MC–364–D in order to prevent damage to the reproducing mechanism and loudspeakers. Uncrate, unpack, and check as follows:

a. Clip the three metal bands that bind the shipping box.

b. Pull out the nails with a nail puller, and remove the cover.

c. Tear open the heavy case liner.

d. Remove the outer corrugated carton, the foil barrier, and then the inner corrugated carton to expose the amplifier-turntable unit case and the loudspeaker case assembly.

e. Remove the cardboard fillers.

f. Lift the reproducing equipment from the box.

g. Unstrap the two cases and lift them from the wooden base.

h. Open all the latches of the amplifier-turntable unit case; remove the top cover and front cover from the hinges.

(1) Check the contents of the case against those listed in the table of components (par. 4).

(2) Open the small access door on the control panel by pulling outward on the two thumb knobs (fig. 4). Be sure that the vacuum tubes are mounted securely in their sockets.

i. Open the latches of the loudspeakers case assembly and separate the two sections.

(1) Remove the two rear covers and check the contents against those listed in the table of components (par. 4).

(2) Inspect the loudspeaker diaphragm for damage and check the cords for kinks and cracks.

Caution: This equipment has been weatherproofed. *Do not* damage this protective coating.

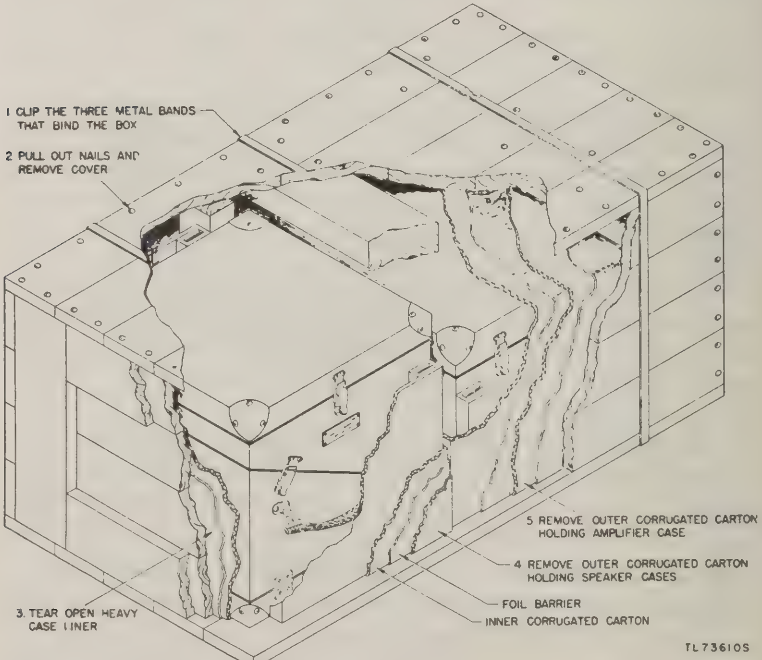

1 CLIP THE THREE METAL BANDS THAT BIND THE BOX
2 PULL OUT NAILS AND REMOVE COVER
3. TEAR OPEN HEAVY CASE LINER
5 REMOVE OUTER CORRUGATED CARTON HOLDING AMPLIFIER CASE
4 REMOVE OUTER CORRUGATED CARTON HOLDING SPEAKER CASES
FOIL BARRIER
INNER CORRUGATED CARTON
TL73610S

Figure 10. Cutaway view of export package.

9. Connections and Interconnections (fig. 11)

a. CONNECTIONS FOR USE AS A REPRODUCER. (1) Throw the 230V–115V toggle switch into position to match the voltage of the power source. Tighten the thumbscrew to lock the switch in this position to prevent accidental throwing of the voltage selector switch during operation.

(2) Connect the free end of each loudspeaker cable to SPEAKER connectors P5 and P6 on the control panel. These connections must be made before the power switch is turned on during operation; otherwise the output tubes may be damaged.

(3) Connect one end of the a-c power cable to the power INPUT male connector P3 on the control panel. Connect the two-contact male connector on the cable to the power source.

b. CONNECTIONS FOR USE AS PUBLIC ADDRESS SYSTEM. (1) Perform the connections and operations of subparagraphs *a*(1) through *a*(3) above.

(2) Connect one end of the microphone cord to the amplifier-turntable unit at the connector, J2, marked MIC on the control panel. Connect the other end of the cord to the threaded male connector on the microphone (fig. 9).

Note. If the equipment is to be used later solely for reproduction, it is not necessary to disconnect the microphone cord from the input connector; however, keep the MIC GAIN control at 0 position to avoid noise.

c. CONNECTIONS FOR DUAL OPERATION. When Reproducing Equipment MC–364–D is to be used as a public address system with a musical (or other desired sound effects) background, perform the same operations and make the same connections as when the equipment is to be used as a public address system only (*b* above).

d. CONNECTIONS FOR USE WITH FILM STRIP PROJECTOR. Make the same connections as when the equipment is to be used as a sound reproducer (*a* above). Connect the power cable of the film strip projector to the utility OUTLET, J4, on the control panel.

10. Repacking

a. Place the reproducer arm on the rest provided and clamp the arm into position by means of the thumbscrew.

b. Tighten the two wingnuts on the U-shaped yoke to hold the motor frame stationary.

c. Disconnect all cords and cables from the amplifier-turntable unit and rewind the cables on the brackets in the loudspeaker housing covers. Strap the cables in place.

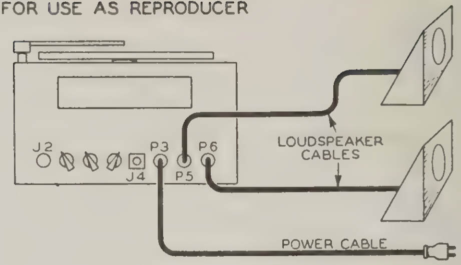
d. Place the microphone in its compartment in loudspeaker case section No. 2.

e. Reassemble the loudspeaker case by latching the rear covers on the two case sections and then latching the two sections together.

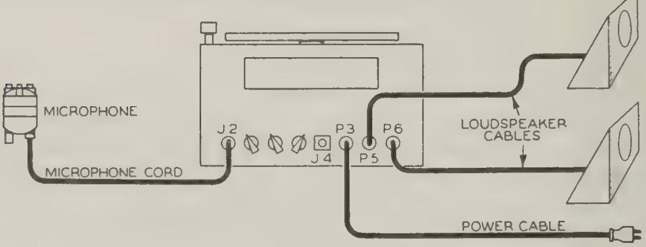
f. Replace the canvas carrying handle on the case assembly.

g. Latch the top and front covers on the amplifier-turntable unit case.

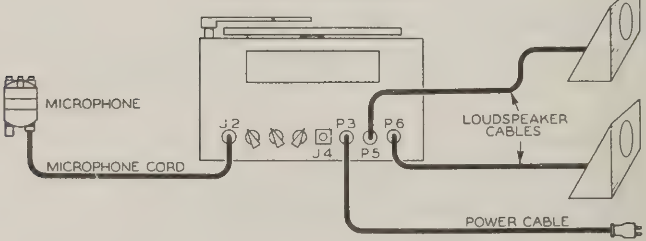
FOR USE AS REPRODUCER



FOR USE AS PUBLIC ADDRESS SYSTEM



FOR DUAL OPERATION



FOR ADJUSTING TURNTABLE SPEED

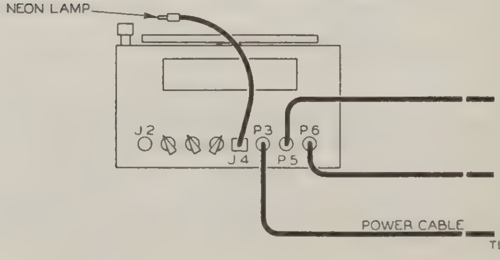


Figure 11. Connection diagrams.

PART TWO
OPERATING INSTRUCTIONS

Section III. CONTROLS AND THEIR USE

11. Controls (figs. 4 and 5)

a. The 230V–115V switch, S3, is a voltage-selector toggle switch. It connects the two primaries of the power transformer in series for 230-volt operation or in parallel for 115-volt operation to match the voltage of the power source being used. A locking thumbscrew prevents accidental throwing of the switch.

b. The TONE-POWER OFF control, R21, serves the two-fold purpose of power on-off switch and tone control.

(1) The power switch S1 is mounted on the rear of the tone control and connects or disconnects the amplifier-turntable unit from the power source. The switch is in its off position when the TONE-POWER OFF knob is turned to the extreme left.

(2) The tone control is a potentiometer which is used as a master tone control to decrease the treble response of the amplifier output. It is designed for linear control over its entire range.

c. The MIC GAIN control, R7, is a potentiometer used to control the volume of the microphone signal in the loudspeakers. Turning the control knob clockwise increases the signal voltage from the microphone to the amplifier; turning the knob counterclockwise decreases the signal voltage.

d. The PHONO GAIN control, R2, is a potentiometer used to control the volume of the reproduction of a recorded disk. Turning this control in a clockwise direction increases the signal voltage which is fed to the amplifier from the phono pick-up (reproducer).

e. The speed change lever (fig. 5) permits the selection of either of two turntable speeds: 33⅓ rpm or 78 rpm. These two positions are indicated on a speed change plate. *Move this lever only when the phono motor is running.*

f. The speed regulator lever (fig. 5) is used to regulate the turntable speed above and below 33⅓ or 78 rpm by changing the governor control setting on the motor. The governor is provided with maximum and minimum stops. Moving the lever towards the F (fast) position on the speed regulator plate increases the turntable speed; moving the lever towards the S (slow) position decreases the turntable speed. Through proper adjustment of this control, the governor can be set so that the turntable revolves at the desired speed. A stroboscope disk and neon lamp may be used to ascertain the exact speed (sec. XIII).

g. The MOTOR ON-OFF switch S2 (fig. 4) is used to start or stop the turntable motor. The power switch must be in its on position before the MOTOR ON-OFF switch becomes effective.

h. The hum control, R30, (fig. 18) is a screwdriver-controlled potentiometer located on top of the amplifier chassis near the rectifier tube (Tube JAN–5Y3GT). It is adjusted to minimize hum output by electrically centering the amplifier tube heaters.

Section IV. OPERATION.

Note. Before connecting Reproducing Equipment MC–364–D to a power source, be sure that the power receptacle is either 115 or 230 volts, 50–60 cycles, and that the voltage selector switch is adjusted accordingly.

12. Starting Procedure

a. Be sure that all connections and interconnections are properly made (par. 9).

b. Insert the two-contact male connector on the power cable into the standard 115- or 230-volt, 50–60 cycle power-source receptacle.

c. Set the 230V–115V switch, S3, for the available line voltage. Tighten the locking thumbscrew (par. 11*a*).

d. Turn all gain controls to 0.

e. Loosen yoke wingnuts so that motor will be suspended freely on its own shock absorbers.

f. Turn the power switch to its on position.

13. Operating Procedures

a. PLAYING RECORDINGS. (1) Proceed as directed in paragraph 12. Turn the TONE-POWER OFF control to its extreme clockwise position ((7) below). When the power pilot light goes on, power is being supplied to the amplifier-turntable unit.

(2) Turn the PHONO-GAIN control clockwise to approximately the center of the scale (scale reading of 5). Allow at least 30 seconds for the amplifier to warm up. Rub the ball of the thumb across the needle in the reproducer arm; clocking noises in the loudspeakers indicate the amplifier is ready for use. Turn the GAIN control to 0.

(3) Place the desired record on the turntable.

(4) Throw the MOTOR switch to ON.

(5) With the turntable rotating, move the speed change lever (fig. 5) to 78 rpm or 33⅓ rpm as required. Move the speed change lever gently to the desired position and *only when the*

motor is running. Do not force the lever; stop the movement when the plate designation of the speed desired is reached. Do not adjust the speed regulator lever; for the propr procedure of synchronizing the turntable motor, see section XIII.

(6) Remove the reproducer from the arm rest and gently place the attached needle in the lead-in groove in the recording, or at any other selected point on the disk desired for reproduction. All standard 78-rpm recordings start from the ring; most 33⅓-rpm recordings start from the center. Starting points on the record are indicated on the record label or title plate.

(7) Adjust the PHONO GAIN control on the control panel for the volume level desired. Volume will depend upon the size of the audience and auditorium.

(8) Turn the TONE-POWER OFF control slowly for desired treble response and to suppress needle noise and surface noise on worn records.

(9) Be sure the MIC GAIN control is in its minimum position (0) to minimize hum or noise in the loudspeakers from this circuit.

(10) When the recording is finished, do not allow the needle to ride in the last groove longer than necessary. Lift gently and replace the reproducer on its rest. Be careful not to drop the reproducer head on the record or turn-table surface. Also, avoid pushing the needle to either side.

b. FOR USE AS A PUBLIC ADDRESS SYSTEM. (1) *Speech amplifier without recorded background.* (*a*) Perform the operations described in paragraph 12. When the power switch is turned on, the POWER pilot light in the center of the control panel should go on.

(*b*) Allow at least 30 seconds for the amplifier to warm up.

(*c*) Speak into the microphone and gradually turn the MIC GAIN control clockwise. Adjust the MIC GAIN control for desired output level in the loudspeakers. As the volume is increased, a howl may be heard in the loudspeaker. This is caused by sound from the loudspeakers which is picked up by the microphone and reamplified; this condition is known as acoustical feedback. To correct this condition, relocate the loudspeakers as far as possible from the microphone so that a maximum desired volume can be obtained without acoustical feedback.

(*d*) Keep the PHONO GAIN control in its minimum position to minimize any noise in the loudspeakers from this circuit.

(*e*) Position the lips about 6 inches from the microphone grill and speak naturally. Turn the TONE-POWER OFF control slowly to obtain the desired tone quality. The final position of the tone control will depend largely upon the voice quality of the speaker. Proper adjustment of the tone control in some cases minimizes acoustical feedback.

(2) *Speech amplifier with recorded background.* To use Reproducing Equipment MC–364–D as a public address system with a background of recorded music, follow the procedures given in *a* and *b*(1) above. To superimpose commentary upon a reproduced recording, also follow the procedures given in *a* and *b*(1) above. During these applications, adjust the MIC GAIN control and PHONO GAIN control to mix any desired level of speech or recording.

14. Stopping Procedure

a. To shut down the equipment after use as a reproducer, stop the turntable by throwing the MOTOR ON-OFF switch to its OFF position; secure the reproducer arm on the pick-up rest; turn off the entire equipment by turning the TONE-POWER OFF control counterclockwise to its OFF position.

b. To shut down the equipment after use as a public address system, move the TONE-POWER OFF control counterclockwise to its OFF position.

c. If Reproducing Equipment MC–364–D is not to be used for a long time after shut-down, disconnect all cords and cables and return them to their respective compartments. Tighten the yoke wingnuts to hold the motor frame stationary. Be certain the tone arm is secured on the arm rest.

Section V. EQUIPMENT PERFORMANCE CHECK LIST

15. Purpose and Use of Check List

a. General. Use of the equipment performance check list helps the operator to determine whether or not Reproducing Equipment MC–364–D is functioning properly. Listed are the *items* to be checked, the *actions* to be performed on the items (or *condition* of the item at the time), the *normal indications* of the correct operation, and the *corrective measures* that the operator should take if the indications are not normal.

b. Action or Condition. For some items the information given in the *action or condition* column consists of the settings of various switches and controls under which the item is to be checked. For other items it represents an action that must be taken in order to check the normal indication given in the normal indication column.

c. Normal Indications. The *normal indications* listed include the visible and audible signs that the operator will perceive when he checks the items. If the indications are not normal, the operator should apply the recommended measures.

d. Corrective Measures. The *corrective measures* are those that the operator can make without turning in the equipment for repairs. If the equipment is completely inoperative and the recommended corrective measures do not yield results, trouble shooting may be necessary. Trouble-shooting information is found in part five of this manual.

16. Equipment Performance Check List

a. WHEN REPRODUCING EQUIPMENT MC–364–D IS USED AS REPRODUCER.

	Item No.	Item	Action or condition	Normal indication	Corrective measures
PREPARATORY	1	Cables (loudspeaker and power).	Connect all components (par. 9).	All connectors and plugs are firmly attached.	Tighten collars on connectors; push plugs firmly into jacks.
	2	230V–115V voltage selector switch.	Throw to 230-volt or 115-volt position as determined by the available line voltage.	Switch is locked in position.	Tighten locking thumbscrew.
	3	GAIN controls.	Turn all GAIN controls to 0.	Controls indicate 0.	Loosen knobs and readjust.
START	4	Power switch.	Turn TONE-POWER OFF switch to extreme clockwise position.	POWER pilot lamp lights up; amplifier tubes light up.	Check cable connections. Check fuse. Replace pilot lamp.
	5	PHONO-GAIN control.	Turn control clockwise to scale reading of 5; after 30 seconds turn control counterclockwise to 0.	Clicking noises are heard when ball of thumb is rubbed across needle (before control is turned to 0).	Check setting of gain control. Check all connectors for proper connections.
	6	Yoke.	Loosen two wing nuts.	Motor is free to suspend on own shock absorbers.	

	Item No.	Item	Action or condition	Normal indication	Corrective measures
EQUIPMENT	7	Record or transcription.	Place record or transcription on turntable.	Record fits snugly.	
	8	MOTOR ON-OFF switch.	Throw to ON.	Turntable should rotate.	Check fuse. Check motor cable connector for proper contact. Check voltage.
PERFORMANCE	9	Speed change control.	While motor is running, move the speed change lever to 78 rpm or to 33⅓ rpm as required by the record or transcription. Stop movement when pressure is felt at the exact designation on the speed change plate.	Turntable should rotate at the desired speed.	Move the speed change lever out of position and then slowly back into position.
	10	Reproducer head (phono pick-up).	Place into first groove of recording.		
	11	PHONO GAIN control.	Adjust to volume level desired.	Recording is heard.	Check tubes in amplifier. Check all connectors.
	12	MIC GAIN control.	Turn gain control to 0 position.		

	Item No.	Item	Action or condition	Normal indication	Corrective measures
STOP	13	Reproducer head.	Lift gently and replace on rest.		
	14	MOTOR ON-OFF switch.	Throw to OFF position.	Turntable stops rotating.	Check switch.
	15	TONE-POWER OFF.	Turn counterclockwise to POWER OFF position.	Pilot lamp goes out.	Check switch.

b. When Reproducing Equipment MC–364–D Is Used as Public Address System.

	Item No.	Item	Action or condition	Normal indication	Corrective measure
PREPARATORY	1	Cord and cables (loudspeakers, power, and microphone).	Connect all components (par. 9).	All connectors and plugs are firmly attached.	Tighten collars on connectors; push plugs firmly into jacks.
	2	230V–115V voltage selector switch.	Throw to 230-volt or 115-volt position as determined by the available line voltage.	Switch is locked in position.	Tighten locking thumbscrew.
	3	GAIN controls.	Turn all gain controls to 0.		
	4	Microphone.	Connect to MIC input (J2).		

	Item No.	Item	Action or condition	Normal indication	Corrective measures
START	5	Power switch.	Turn TONE-POWER OFF switch to extreme counterclockwise position.	POWER pilot lamp lights up; amplifier tubes light up.	Check cable connections. Check fuse. Replace pilot lamp.
EQUIPMENT PERFORMANCE	6	MIC GAIN control.	Turn MIC GAIN control clockwise and adjust for desired output level in loudspeakers.	Reproduction of voice from loudspeakers.	Check microphone connector. Check loudspeaker connectors. Be sure MIC GAIN control is advanced sufficiently. If howl is heard, relocate loudspeakers or microphone.
	7	TONE-POWER OFF control.	Turn counterclockwise to obtain desired tone quality.	Reduction of treble.	

STOP	8	Power switch.	Turn TONE-POWER OFF switch counterclockwise to POWER OFF position.	POWER pilot light goes off.	Check switch.

PART THREE
MAINTENANCE INSTRUCTIONS

Section VI. PREVENTIVE MAINTENANCE TECHNIQUES

17. Meaning of Preventive Maintenance

Preventive maintenance (PM) is a systematic series of operations performed at regular intervals on equipment, when turned off, to eliminate major break-downs and unwanted interruptions in service, and to keep the equipment operating at top efficiency. To understand what is meant by PM, it is necessary to distinguish PM from trouble shooting and repair. The prime function of preventive maintenance is to *prevent* break-downs and therefore the need for repair. The prime function of trouble shooting and repair is to locate and correct existing defects. The importance of PM cannot be overemphasized. It is vitally important that operators and repairmen maintain their equipment properly. See TB SIG 123, Preventive Maintenance Practices for Ground Signal Equipment.

Note. The operations given in section VI and VII are organizational (organization operators and repairmen) maintenance operations. Some operations given in section IX are higher echelon maintenance operations.

18. Description of Techniques

a. GENERAL. Most of the electrical parts used in Reproducing Equipment MC–364–D require routine preventive maintenance. These parts differ in the amount and kind of maintenance required. Because hit-or-miss maintenance techniques cannot be applied, definite and specific instructions are needed. This section of the manual contains these specific instructions and serves as a guide for personnel assigned to perform the six basic maintenance operations; namely, Feel, Inspect, Tighten, Clean, Adjust, and Lubricate. Throughout this manual the lettering system for the six operations will be as follows:

F—Feel
I—Inspect
T—Tighten
C—Clean
A—Adjust
L—Lubricate

The first two operations establish the need for the other four. The selection of operations is based on a general knowledge of field needs. For example, the dust encountered on dirt roads during cross-country travel filters into the equipment no matter how much care is taken to prevent it. Rapid changes in weather (such as heavy rains followed by blistering heat), excessive dampness, snow and ice tend to cause corrosion or deterioration of exposed surfaces and parts. Without frequent inspections and the necessary performance of tightening, cleaning, and lubricating operations, equipment becomes undependable and subject to breakdown when it is most needed.

b. FEEL. The feel operation is used most often to check transformers, chokes, rotating machinery, such as the phono motor, and to determine if electrical connections, bushings, etc., are overheated. Feeling indicates the need for lubrication of moving parts or the existence of similar types of defects requiring correction. The maintenance man must become familiar with the normal operating temperatures of motors, etc., in order to recognize signs of overheating.

Note. It is important that the feel operation be performed as soon as possible after the shut-down and always before any other maintenance is done.

c. INSPECT. (1) *General.* Inspection is the most important operation in the PM program. A careless observer will overlook the evidences of minor trouble. Although these defects may not interfere with the performance of the equipment, time and effort can be saved if they are corrected before they lead to major breakdowns. Make every effort to become thoroughly familiar with the indications of normal functioning, in order to be able to recognize the signs of a defective set.

(2) *Inspection.* Inspection consists of carefully observing all parts in the equipment, noticing their color, placement, cleanliness, etc. Inspect for the following conditions:

(*a*) Overheating, as indicated by discoloration, blistering, or bulging of the part or surface of the container; leakage of insulating compounds; and oxidation of metal contact surfaces.

(*b*) Placement, by observing that all leads and cabling are in their original positions.

(*c*) Cleanliness, by carefully examining all recesses in the units for accumulated dust, especially between connecting terminals. Parts, connections, and joints should be free of dust, corrosion, and other foreign matter. In tropical and high-humidity locations, look for fungus growth and mildew.

(*d*) Tightness, by testing any connection or mounting which appears to be loose, by gently pulling on the wire, or by feeling the lug or terminal screw.

d. TIGHTEN, CLEAN, AND ADJUST. (1) These operations are self-explanatory. Specific procedures to be followed in performing them are given wherever necessary throughout part three.

Caution: Screws, bolts, and nuts should be tightened carefully. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

(2) Whenever a loose connection is tightened, it should be weatherproofed again by applying the protective varnish with a small brush. See section IX for details of weatherproofing Reproducing Equipment MC–364–D.

e. LUBRICATE. Lubrication refers to the application of grease or oil to the bearings of motors or rotating shafts. It may also mean the application of a light oil to door hinges or other sliding surfaces on the equipment.

19. Capacitors

Before maintenance work is begun, it is absolutely necessary for the safety of personnel to short-circuit all high-voltage capacitors with a well-insulated screwdriver.

a. INSPECT. (I). (1) Inspect the terminals of the capacitors for corrosion and loose connections. Examine the mounting for any other loose mounting screws, studs, or brackets. Check the leads for poor insulation, for cracks, and for evidence of dry rot. Cut away frayed strands on the insulation. If the wire is exposed, wrap it with friction tape. The terminals of the capacitors should not be cracked or broken.

(2) Thoroughly inspect the case of each capacitor for bulges and discoloration.

b. TIGHTEN (T). Tighten loose terminals, mountings, and connections on the capacitors.

c. CLEAN (C). (1) Clean the case of the capacitor, the insulating bushings, and any connections that are dirty or corroded. The capacitor cases and bushing can usually be cleaned with a dry cloth, but if the deposit of dirt is difficult to remove, moisten the cloth in solvent, dry cleaning (SD).

(2) Carefully dry the bushings with a dry cloth after they are cleaned. Corroded connections should be polished with No. 0000 sandpaper and then tightened securely.

20. Resistors

a. INSPECT (I). Inspect the bodies of all types of resistors for blistering, discoloration, and other indications of overheating.

Inspect all connections for corrosion, dirt, dust, looseness, and broken strands in the connecting wires. Check the security of all mountings. Do not attempt to move resistors having pigtail connections because there is danger of breaking the connections at the point where they enter the body of the resistor. Such defects cannot be repaired.

b. TIGHTEN (T). Tighten resistor connections and mountings whenever they are loose. If a resistor is allowed to remain loose, vibration may break the connection or damage the body.

c. CLEAN (C). (1) Clean all dirty connections on the resistors, using a cloth or a brush dipped in solvent (SD). Polish corroded connections lightly with No. 0000 sandpaper and wipe with a clean dry cloth.

(2) Resistors with discolored bodies cannot be cleaned. Discoloration is indicative of overloading at some time prior to the inspection and is probably due to circuit trouble. Circuit trouble requires analysis.

21. Transformers

Transformers must be replaced if defective, but PM techniques give some amount of protection against failure at inopportune times.

a. FEEL (F). Feel transformers for signs of overheating. For other than hermetically sealed types, a sure sign of overheating is the presence of insulating compound on the outside of the case. Overheating is an indication of circuit trouble or inadequate ventilation and requires a system analysis and correction.

b. INSPECT (I). Inspect transformers for general cleanliness and for tightness of connecting lugs or terminals, mounting brackets, and rivets. Dust, dirt, or moisture between the terminals of transformers may cause flash-over or excessive leakage.

c. TIGHTEN (T). (1) Tighten loose mounting screws or connections.

(2) If it is necessary to remove wires to tighten loose parts, note the position of the wires before they are disconnected, and then restore them to their original positions.

d. CLEAN (C). (1) Clean the cases of the transformers with a dry cloth. Where necessary use solvent (SD) to remove encrusted dirt.

(2) Polish corroded contacts or connections with No. 0000 sandpaper and wipe clean with a clean cloth.

(3) Remove corrosion from ground connections and from resoldered connections.

22. Vacuum Tubes

Note. Avoid working on tubes immediately after shut-down. Severe burns may result from contact with the envelopes of hot tubes.

To gain access to the vacuum tubes, open the small tube access door (fig. 12) on the control panel by pulling outward on the two thumb knobs.

a. INSPECT (I). (1) Examine all tube envelopes for dirt and corrosion. Check for tube envelopes that have broken away from the tube base. Replace tubes which have loose envelopes or elements.

(2) Inspect the firmness of the tubes in their sockets. Make the inspection by pressing the tubes down in their sockets and testing them in that position. Partly withdrawing the tubes and jiggling them from side to side tend to weaken the pins in the base and spread the contacts in the sockets. Inspect the tube sockets at the time the tubes are removed.

(3) Always remove tubes from their sockets carefully. Never jar a warm tube. Store tubes carefully after they have been removed from the sockets; do not place the tubes on elevated flat surfaces without proper precautions to prevent their rolling to the ground or floor.

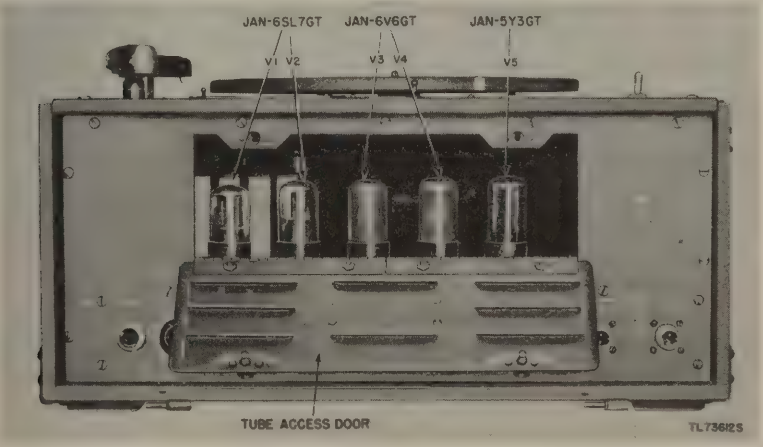


Figure 12. Tube access door opened, showing tube location.

b. TIGHTEN (T). Tighten all loose connections to the tube sockets. If connections are dirty or corroded, clean them before tightening.

c. CLEAN (C). Remove dust and dirt from the tube envelopes with a clean, lint-free dry cloth. When tube sockets are cleaned and the contacts are accessible, No. 0000 sandpaper may be used to remove corrosion, oxidation, and stubborn dirt.

23. Potentiometers

a. INSPECT (I). (1) Inspect the mechanical condition of the potentiometers (gain and tone controls). The arm should be keyed tightly to the shaft, and the shaft should turn easily in the bushing which supports it. Poor contact between the arm and the resistor winding is caused by insufficient tension in the arm. Do not attempt disassembly or repair of sealed-type potentiometers.

(2) Inspect the assembly and mounting screws, setscrews, and nuts.

(3) Inspect the insulating body and metallic parts of the potentiometers for dust, cracks, or chipped places.

b. TIGHTEN (T). Tighten loose mounting nuts. To remove the knob, rotate the knob counterclockwise as far as it will go, loosen the setscrew, and remove the knob. Tighten the mounting nut and replace the knob, using the 0 calibration mark on the panel to position it correctly.

c. CLEAN. (C). With a brush or cloth, clean the body of the potentiometer and the connections whenever they are dirty or corroded. Remove grease and dirt from external parts with the dry-cleaning fluid. Apply the solvent sparingly; do not allow it to penetrate to interior of potentiometer as the resistance element may be permanently damaged.

24. Switches

a. INSPECT (I). Check the mechanical action of each switch and look for dirt or corrosion on all exposed elements.

b. TIGHTEN (T). Tighten all switch mounting nuts.

c. CLEAN (C). Clean the exterior surfaces of switches with a stiff brush moistened with dry-cleaning solvent, and wipe dry with a piece of cloth. Clean all dirty contacts with a cloth or brush dipped in solvent (SD). Remove corrosion with No. 0000 sandpaper.

25. Jacks

Jacks require little attention and only at infrequent intervals. Occasionally it will be necessary to tighten the mounting nuts, clean the contacts, or increase the spring tension. Remove dirt with a brush and solvent (SD), and remove corrosion with a piece of No. 0000 sandpaper. Increase spring tension when necessary by grasping the spring near its point of attachment with a pair of long-nose pliers. Twist the pliers slightly in the direction in which tension is desired and move them continuously along the slight bow in the spring. The action of the jack should be tried after each adjustment. Keep all soldered connections clean and intact.

26. Plugs

a. INSPECT (I). Inspect plugs for dirt, corrosion, damaged or loose contacts or terminals.

b. CLEAN (C). Clean plugs with metal polish. Do not apply an excessive amount of polish. Be sure to remove all of the residue of the polish after cleaning operations in order to maintain good electrical contact.

27. Cords and Cables

The cables can be regarded as the life lines of the equipment. The condition of the cabling must be closely observed.

a. INSPECT (I). Inspect the cables for cracked or deteriorated insulation, frayed or cut insulation at the connecting and supporting points, and improper placement which places the cables or connections under strain. Watch for kinks and improper supports. Be sure all grounding connections are clean and tight.

b. TIGHTEN (T). Tighten loose cable clamps, coupling rings, and cable connectors.

c. CLEAN (C). Clean dirty and corroded connectors with a stiff bristled brush dipped in solvent (SD) ; dry thoroughly with a cloth. Corroded connectors can be cleaned by lightly polishing with No. 0000 sandpaper. Clean the entire surface of the contacts. Do not remove individual prongs from the cable plugs. Be sure no dirt or corrosion remains between contacts or short circuiting may result.

28. Microphone

a. INSPECT (I). Inspect the microphone housing for dirt and cracks; examine the connector at the base of the microphone head for corrosion. *Do not attempt any disassembly of the microphone.*

b. CLEAN (C). Clean the microphone housing with a clean dry cloth. Use the dry-cleaning solvent to clean dirt or rust in the connector at the base of the microphone head. Do not allow water or cleaning solvent to enter the microphone head.

29. Cases and Control Panels

a. INSPECT (I). Inspect all cases and the control panel for dirt. Check catches on sides and covers of all cases. Check for chipped paint and cracked wood. Inspect the weatherproof gasket on all covers for tears or deterioration. Inspect all knobs for free rotation on their respective shafts. Remove the fuse and inspect for corrosion; make sure that the fuse fits properly in its holder. Check the pilot lamp for dirt. Check all mounting screws or nuts for looseness.

b. TIGHTEN (T). Tighten all loose mounting nuts, bolts, and screws. Tighten all control knobs. Tighten nuts on all case catches and handles.

c. CLEAN (C). Clean the amplifier and turntable panels with a soft clean cloth. Use the dry-cleaning solvent (SD) if necessary. Wipe all cases with a damp cloth. If the cases are muddy, use brush and water. Remove rust or corrosion with No. 0000 sandpaper. Be sure to install all covers on the cases being cleaned.

d. LUBRICATE (L). Refer to paragraph 38*d*.

30. Loudspeakers

a. INSPECT (I). Inspect the loudspeakers for dust, dirt, or other foreign matter. Inspect for tightness of connections, terminals, and mountings. Inspect the grills for damage.

b. CLEAN (C). With a clean dry cloth, clean all dirt and dust from the speakers. Be careful not to damage the speaker cones.

31. Pilot Lamps

a. INSPECT (I). Inspect the pilot lamp assembly for loose lamp, loose mounting screws, cracked cap, and loose or dirty connections.

b. TIGHTEN (T). Tighten loose mounting screws and resolder any loose connections. If the connections are dirty or corroded, clean them before soldering.

c. CLEAN (C). Clean corrosion from lamp base and socket with No. 0000 sandpaper.

32. Turntable Motor and Reproducer Head

a. FEEL (F). Feel the turntable motor for signs of overheating. Perform this operation immediately after shut-down of the equipment. The motor will be hot to the touch after several hours of use in hot weather. Make allowances for the lack of ventilation and other factors that might cause excessive heating of the motor.

b. INSPECT (I). Check the motor housing for excess dirt and oil. Check the wires from the switch and transformer terminals.

Check all soldered joints and connections for imperfect welds and rosin-held splices. Inspect for tightness of all leads, mounting nuts, and speed control levers. Rotate reproducer arm to check for freedom from binding at any point in its operating range. Inspect the hold-down clamp. Inspect the wiring inside the reproducer arm for loose connections. Inspect the needle for secure mounting in the needle chuck and for excessive wear. Excessive wear is indicated by a flat spot on the tip or by excessive surface noise from recordings when the equipment is in use.

c. TIGHTEN (T). Tighten all loose mounting nuts and screws. Tighten speed control clamps and all wiring connections. Tighten the mounting screws on the reproducer-head arm.

d. CLEAN (C). (1) Lift the turntable off the motor spindle and remove any dirt or lint present on the moving parts; use a stiff bristled brush. Wipe the under side of the turntable and around the oil holes.

(2) Lightly wipe the rubber washer with a cloth moistened with solvent (SD) if it shows signs of oil on its surface. Clean with the dry-cleaning solvent only when absolutely necessary; improper and frequent use of the solvent is injurious to the washer. Follow with a clean dry cloth; be sure to remove all traces of oil and solvent.

(3) Clean the reproducer head.

e. ADJUST (A). (1) Adjust the position of the speed change lever as follows:

(*a*) Tighten the clamp nut at the rear end of the lever.

(*b*) Start the turntable motor.

(*c*) Move the lever gently to the 33⅓- or 78-rpm position. Stop the movement of the lever when the pressure is felt at the approximate dial plate designations of the speed desired.

(*d*) Loosen the clamp nut, and adjust the lever to the exact position and retighten nut.

(2) Adjust the position of the speed regulator lever as follows (sec. XIII):

(*a*) Tighten the clamp nut at the rear end of the lever.

(*b*) Start the turntable motor.

(*c*) Move the lever as far as it will go to the F (fast) position.

(*d*) Loosen the clamp nut, adjust the lever to the position marked F, and retighten nut.

f. LUBRICATE (L). Lubricate in accordance with procedures given in paragraphs 37 and 38.

Section VII. ITEMIZED PREVENTIVE MAINTENANCE

33. Introduction

For ease and efficiency of performance, preventive maintenance on Reproducing Equipment MC–364–D is broken down into operations that can be performed at different time intervals. In this section, the preventive maintenance work that can be performed on the equipment at the specified time intervals is broken down into units of work called items. The general techniques involved and the application of the FITCAL operations in performing preventive maintenance on individual parts are discussed in section VI. These general instructions are not repeated in this section. When performing preventive maintenance, refer to section VI if more information is required for the following items. All work is to be performed with the power removed from the equipment. After preventive maintenance has been performed on a given day, the equipment should be put into operation and checked for satisfactory performance. (See par. 16)

34. Preventive Maintenance Tools and Materials

The following preventive maintenance tools and materials will be needed to perform preventive maintenance operations:

Screwdriver.
Clean cloth.
No. 0000 sandpaper.
Metal polish (Signal Corps stock No. 6G1516).
Stiff bristled brush.
Dry-cleaning solvent (SD).

Note. Gasoline will not be used as a cleaning fluid for any purpose.

35. Itemized Preventive Maintenance Operations

a. ITEM 1, AMPLIFIER-TURNTABLE HOUSING (fig. 4).

OPERATIONS:

ITC	Housing.

b. ITEM 2, AMPLIFIER UNIT (fig. 4).

PRELIMINARY STEPS. Remove the amplifier from its housing case by removing the four screws which secure the unit to the floor of the case.

OPERATIONS:

ITC	Tubes and sockets.
ITC	Capacitors.
ITC	Resistors.

ITC	Potentiometers.
ITC	Switches.
FIT	Transformers.
ITC	Pilot lamp.
ITC	Wiring and connections.
F	Control knobs.

c. Item 3, Turntable Assembly (figs. 5, 6, and 13).

OPERATIONS:

FITCAL	Turntable motor.
IT	Motor mounting.
ITA	Speed regulator lever.
ITA	Speed change lever.
IC	Rubber drive washer.
ITC	Cable connections.
IC	Turntable.
ITCA	Reproducer arm.

d. Item 4, Loudspeaker Sections.

OPERATIONS:

ITC	Housings.
ITC	Cable connections.
IC	Loudspeakers.

e. Item 5, Microphone and Microphone Cord.

OPERATIONS:

ITC	Microphone.
ITC	Cord connections.

f. Item 6, Power Cable.

OPERATIONS:

ITC	Cable connections.

36. Preventive Maintenance Check List

The following check list is a summary of the preventive maintenance operations to be performed on Reproducing Equipment MC–364–D. Time intervals shown on the check list may be varied at any time by the individual in charge. However, for the best performance of the equipment perform the operations at least as frequently as specified in the check list. The "Organization Operator —Organization Repairman" column indicates which maintenance operations are to be performed by the operator and which operations are to be performed by the organization repairmen. Operations are indicated by the letters of the word FITCAL. For example, if the letters ITCA appear in the operations column, the item to be treated must be inspected (I), tightened (T), cleaned (C), and adjusted (A).

Item No.	Operation	Item	When performed			Organization—	
			Daily	Weekly	Monthly	Operator	Repairman
1	ITC	Amplifier-turntable housing	X			X	
2	FITC	Amplifier unit:			X		X
	ITC	Tubes and sockets		X			X
	ITC	Capacitors			X		X
	ITC	Resistors			X		X
	ITC	Potentiometers			X		X
	ITC	Switches			X		X
	FIT	Transformers		X			X
	ITC	Connectors		X		X	
	ITC	Pilot lamp			X	X	
	ITC	Wiring		X			X
	ITA	Control knobs			X	X	
3	FITCAL	Turntable assembly:		X			X
	FITCAL	Phono motor			X		X
	IT	Motor mounting			X		X
	IC	Turntable			X	X	
	ICA	Speed control levers			X		X
	IC	Rubber drive washer:			X		X
	ITC	Connectors		X		X	
	ITCA	Reproducer arm			X	X	
4	ITC	Loudspeaker					
		Sections			X	X	
	ITC	Housing		X		X	
	ITC	Cables and connectors	X			X	
	ITC	Loudspeakers		X		X	
5	ITC	Microphone	X			X	
6	ITC	Power cord	X			X	

Section VIII. LUBRICATION

37. Approved Lubricants for Reproducing Equipment MC–364–D

The following table lists the lubricating materials necessary in servicing Reproducing Equipment MC–364–D.

Symbols	Nomenclature
GL	GREASE, lubricating, special
PL	OIL, lubricating, preservative, special
OE–10	OIL, engine

Note. When the temperature is so high that lubricating oil (PL–SPECIAL) runs off the parts, substitute oil OE–10.

38. Lubrication of Turntable Motor, Reproducer Arm, and Case

a. GENERAL. (1) *Cleaning.* Clean parts with a lint-free cloth or a stiff bristled brush moistened with solvent (SD). Allow parts to dry thoroughly before applying lubricant. Always clean before applying lubricant.

Note. Gasoline will not be used as a cleaning fluid for any puspose.

(2) *Lubricating.* Do not lubricate excessively. Lubrication points difficult to reach may be lubricated with the aid of a small bare wire formed into a loop at one end. Remove excess lubricant. Natural rubber will deteriorate if oil or grease come in contact with it.

(3) *Intervals.* The lubrication interval stated in this section is a maximum and is based on a normal 8-hour day operation. For abnormal activities or conditions, shorten the interval to compensate for the additional wear.

b. TURNTABLE MOTOR. Lubricate the turntable motor once a month. The three oil holes located under the turntable are shown in figure 13.

(1) Remove the turntable unit from the case.

(2) Remove the turntable from the spindle by first removing the modified C washer and then pulling up the turntable. Remove the rubber drive washer.

(3) Apply 2 to 3 drops of oil (PL-SPECIAL) to each of the three lubrication points.

(4) Wipe off excess oil around the holes and examine the motor for dirt. Clean, if necessary, with solvent (SD).

(5) Replace the turntable in its case.

Note. For instructions on the disassembly and lubrication of turntable unit by field and base maintenance repairmen, refer to paragraph 58.

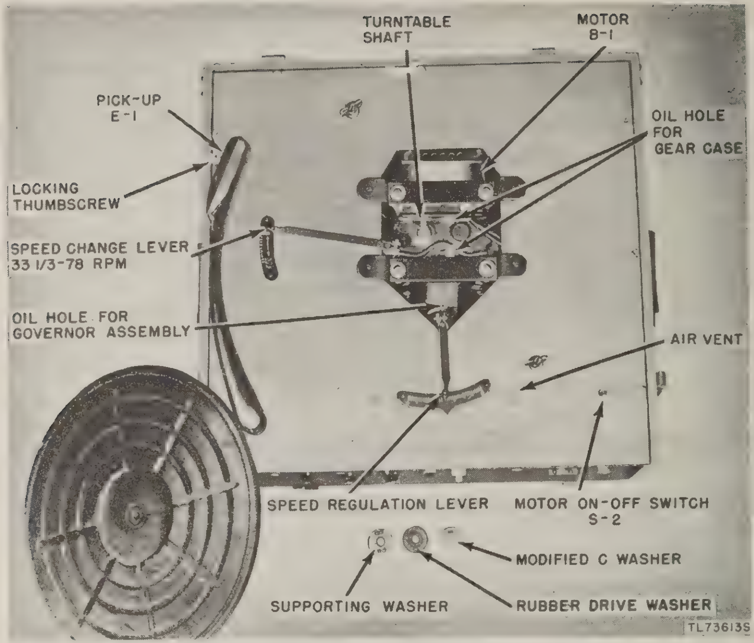


Figure 13. Turntable unit, top view, turntable removed.

c. REPRODUCER ARM. Apply 1 drop of oil (PL-SPECIAL) to each of the pivot bearings.

d. CASE. Apply a few drops of engine oil (OE-10) to fasteners, hinges, and latches.

Section IX. WEATHERPROOFING

39. General

Signal Corps equipment, when operated under severe climatic conditions which prevail in the tropical, arctic, or desert regions, requires special treatment and maintenance.

40. Tropicalization

a. GENERAL. Because fungus growth, insects, corrosion, salt spray, and excessive moisture affect most materials adversely, a special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. Refer to TB SIG 13 for a detailed description of the varnish-spray method of moistureproofing and fungiproofing the supplies and equipment required in this treatment. The following problems may be encountered:

(1) Resistors, capacitors, transformer windings, etc., fail because of the effects of fungus growth and excessive moisture.

(2) Electrolytic action, often visible in the form of corrosion, takes place in resistors and transformer windings causing eventual break-down.

(3) Hook-up wire insulation and cable insulation break down. Fungus growth accelerates deterioration.

(4) Moisture forms electrical paths on terminal boards and insulation strips.

Caution: Varnish spray may have poisonous effects if inhaled. To avoid inhaling spray, use a respirator if available; otherwise fasten cheesecloth or other cloth material over nose and mouth. Never spray varnish or lacquer near an open flame. Do not smoke in a room where varnish or lacquer is being sprayed. The spray may be highly explosive.

b. REPRODUCING EQUIPMENT MC–364–D. The equipment is protected against deterioration under tropical climatic conditions by a moistureproofing and fungiproofing varnish treatment applied at the time of manufacture. If retreatment is necessary, use the procedure given in TB SIG 13, with the following precautions:

(1) Do not treat the motor, turntable, and reproducer arm and head assembly.

(2) Remove the amplifier chassis from its housing; treat in accordance with TB SIG 13.

(3) *Do not treat speaker assemblies.* Brushcoat terminal strips only.

c. MOISTUREPROOFING AND FUNGIPROOFING AFTER REPAIRS. If the coating of protective varnish has been punctured or broken during repair and if a complete treatment is not needed to reseal the equipment, apply a brush coat to the affected part. Be sure the break is completely sealed.

41. Winterization

a. GENERAL. Special precautions are necessary to prevent poor performance or total operational failure of equipment in subzero temperatures. Most signal equipment can be used in winter if difficulties common in low temperatures are anticipated and precautions taken to prevent them. For operation purposes, place equipment in heated rooms whenever possible. Wrap it in blankets when on the march to protect it from winds and freezing temperatures. Refer to TB SIG 66 for complete information.

The following problems may be encountered:

(1) *Steel.* Steel shrinks and becomes brittle in subzero weather.

(2) *Glass.* Glass is especially susceptible to sudden temperature changes.

(3) *Rubber.* Prewar rubber resists cold weather well, but certain types of synthetic rubber are unreliable and become brittle.

(4) *Canvas.* Canvas freezes and loses its pliability in cold weather.

(5) *Lubricants.* Lubricants become stiff, causing drag and also causing moving parts to stick. Refer to section VIII for detailed lubrication instructions.

b. REPRODUCING EQUIPMENT MC–364–D. The equipment performs satisfactorily under low-temperature operating conditions. When the equipment is to be used at low temperatures, always allow maximum possible warm-up time prior to operation. Before operation, if possible, allow the equipment to stand, with power off, in a heated shelter. Never attempt to use the equipment unless the turntable motor operates freely and the turntable can be adjusted to the proper speed. Refer to TB SIG 66 for additional cold-weather operation data.

42. Dustproofing

a. GENERAL. Signal Corps equipment operated in desert localities is affected by the extremely high temperatures and the amount of dust, dirt, sand, and other foreign matter in the air. Care should be exercised to prevent such elements from filtering into lubricated parts. Cover the equipment when it is not in use. Thorough cleanliness is imperative. Whenever possible, clean and lubricate all moving parts, instead of merely adding new lubricants at regular intervals. If possible, inspect and clean the equipment daily. (Refer to TB SIG 75.) Some of the problems encountered are the following:

(1) *Lubricants.* Lubricants become thin and drain rapidly from the moving metal and fiber parts. Refer to section VIII for detailed lubrication instructions.

(2) *Foreign matter.* Foreign matter, such as dirt, dust, and sand, acts as an abrasive causing excessive wear, clogging, and impeding the flow of air.

b. REPRODUCING EQUIPMENT MC–364–D. The instructions given in TB SIG 75 are adequate to prevent equipment failure due to dust or dirt infiltration.

PART FOUR
AUXILIARY EQUIPMENT

(Not used)

PART FIVE
REPAIR INSTRUCTIONS

Section X. THEORY OF OPERATION

43. General

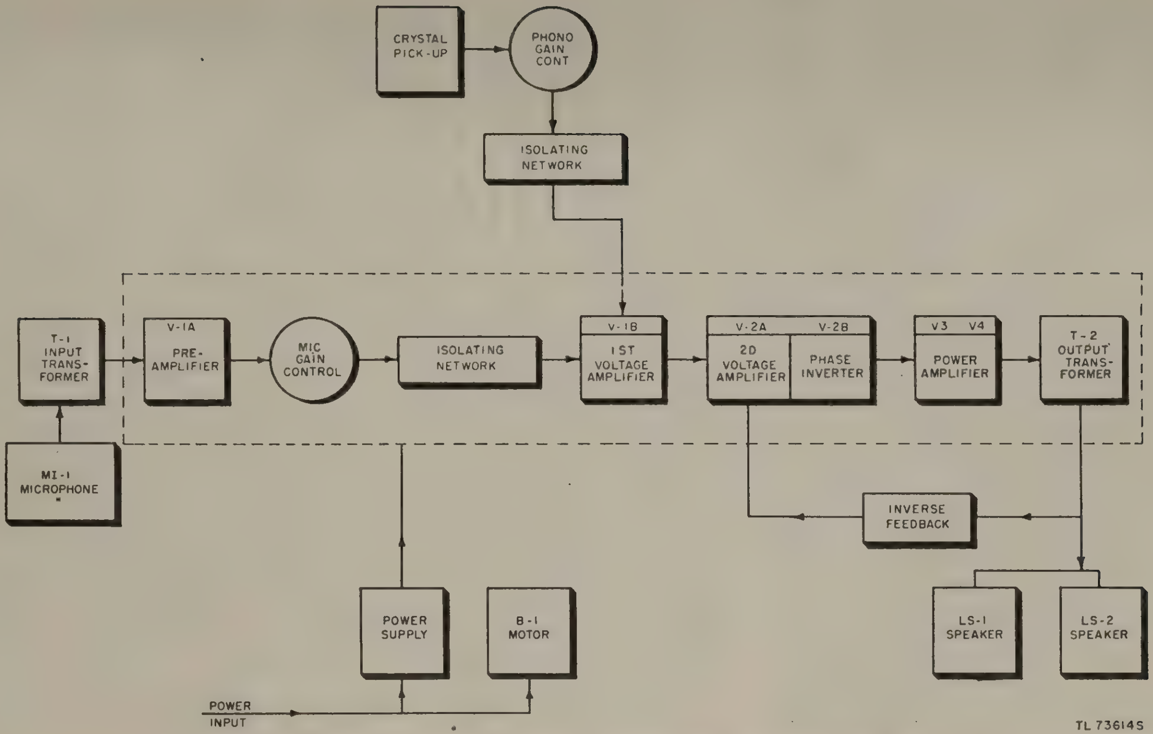
a. The amplifier unit is a five-tube amplifier which uses two twin-trode tubes, V1 and V2, in the first and driver-inverter stages. The power amplifier consists of two tubes, V3 and V4, arranged in push-pull. V1 and V2 are designated as Tubes JAN–6SL7GT, the power tubes are Tubes JAN–6V6GT, and the rectifier V5 is Tube JAN–5Y3GT.

b. Figure 14 is a block diagram of the signal paths through the various stages of the reproducing equipment. The microphone signal is fed through the input transformer, T1, and then through the isolating network into the microphone preamplifier V1A (one half of first twin-triode tube). The signal from the turntable unit is fed through the isolating network to the first voltage amplifier V1B (second half of first twin-triode tube). The MIC GAIN control, R7, and the PHONO GAIN control, R2, regulate the amount of signal fed from the microphone and turntable unit respectively to the first voltage amplifier. The signal is then fed to the second voltage amplifier and phase inverter, V2A and V2B. The signal from the phase inverter is then fed into the power amplifier, V3 and V4, from which it is coupled to the two loudspeakers through output transformer T2.

44. Reproducing Process

a. The function of the reproducer arm and pick-up is to transmit impulses from the record to the amplifier. Small electrical currents generated by the crystal pick-up are impressed upon the amplifier tubes, amplified to the desired level, and delivered to the loudspeakers.

b. The needle chuck which retains the needle is attached to a crystal; this crystal is therefore subjected to a variable pressure depending upon the lateral vibrations of the needle. When pressure is applied to a crystal, a small voltage appears on the opposite faces of the crystal (the piezoelectric effect). Thus, any lateral vibrations of the needle creates a similar pressure against the crystal which results, in turn, in a voltage whose magnitude corre-



TL 73614S

Figure 14. Simplified block diagram of Reproducing Equipment MC–364–D.

sponds to the changes in pressure. This voltage is fed to the input of the amplifier.

45. Speech Amplifying Process

Sound waves are picked up or made to impinge upon the diaphragm in the microphone. The diaphragm vibrates in a manner corresponding to the variations in the pitch and loudness of the original sound. A small coil or armature (mounted on the diaphragm) in the microphone will move in a manner similar to the diaphragm. Since this coil is mounted in the field of a permanent magnet, any movement of the coil cuts the magnetic field passing through the coil. Voltages, corresponding to the change of the coil position, are induced in the coil. These voltages are fed to the amplifier through input transformer T1. The greatly amplified voltage that appears across the output transformer is fed to the loudspeakers where it is converted back into sound waves.

46. Amplifier Circuit Analysis (fig. 25)

The amplifier is the resistance-coupled type, with phase inversion. The amplifier contains its own built-in power supply.

a. PHONO AMPLIFICATION. (1) The signal from the crystal pick-up (E1) is introduced through the tip of jack J1, load resistor R1, and PHONO GAIN control R2. The ring of J1 and one end of potentiometer R2 are grounded. R1 serves to equalize the signal made up of the various high and low notes.

(2) The signal developed across R2 passes through the isolating network, R3 and C1, and coupling capacitor C5 to the control grid of the second section of Tube JAN–6SL7GT, V1B. Capacitor C1 prevents suppression of the high notes and R3 prevents grounding of the microphone signal when the PHONO GAIN control is adjusted to the minimum resistance position. The grid leak resistor R9 is connected to terminal 4 of V1 and to ground and furnishes the necessary operating bias for the tube. The amplifier signal voltage is fed from the plate of V1B, terminal 5, and developed across resistor R10. Resistors R11 and R33 and capacitors C6 and C18 connected between these resistors and ground provide additional filtering of the direct-current (d-c) plate voltage.

(3) The signal is then fed to grid of the first section of Tube JAN–6SL7GT, V2A, through coupling capacitor C7. Grid resistor R12 is connected between the grid, terminal 1, and ground. Resistor R13 furnishes cathode bias and is connected to ground through resistor R14. The signal is further amplified and developed across plate resistor R16 which is connected between plate

terminal 2 of V2A and resistor R17. Capacitor C8 returns the signal to ground and with resistor R17 provides additional filtering of the d-c voltage. Part of the signal is fed from the grid, terminal 4, of V2B to the tone-control circuit which consists of capacitor C10 and potentiometer R21, the TONE CONTROL. The high frequencies are attentuated or bypassed to ground when R21 is adjusted to a minimum resistance.

(4) The signal is then fed through coupling capacitor C9 to the grid, terminal 4, of the second section of Tube JAN–6S17GT, V2B. V2B serves as the phase inverter. R18 is the grid resistor for V2B and is connected between the grid, terminal 4, and the cathode bias resistor R19. The phase inverter tube provides equal signal voltages of opposite phase which are applied to the grids of the two Tubes JAN–6V6GT, V3 and V4, arranged in push-pull. Phase inversion permits push-pull operation without the need for an audio transformer.

(5) One phase of the signal, which is obtained from the voltage developed across the plate resistor R22, is fed to the grid of V3 at terminal 5 through coupling capacitor C11. In opposite phase, the signal voltage developed in the cathode circuit across resistor R20, connected between resistor R19 and ground, is fed to the grid, terminal 5 of vacuum tube V4, through coupling capacitor C12. Resistors R23 and R24 are the grid resistors for V3 and V4 respectively. Bias for the power tubes V3 and V4 is obtained through the common cathode resistor R25. Capacitor C13, connected across resistor R25, bypasses the audio signal to ground, thus providing balanced operation of the two tubes. From the plates of V3 and V4 the signal is fed to the primary of output transformer T2.

(6) The signal from the secondary of output transformer T2 is routed to the loudspeakers through connectors P5 and P6. A portion of the signal voltage obtained from the secondary of the output transformer at terminal 4 is fed back through R15 to the cathode circuit of the second voltage amplifier, V2A, at the point where resistors R13 and R14 are connected. This type of circuit, where the output voltage is returned opposite in phase to the input of the same tube, is known as inverse-feedback and serves to reduce distortion and/or noise developed in the amplifying section following the second voltage amplifier.

b. SPEECH AMPLIFICATION. (1) The signal from the microphone is introduced through J2, stepped-up in the audio-frequency (a-f) input transformer T1, and fed to the grid, terminal 1 of the first triode section of Tube JAN–6SL7GT, V1A, the microphone preamplifier section. Resistor R4 is connected across the secondary of transformer T1 to match the input impedance of the microphone. From the plate of V1A, the signal voltage is developed across the plate resistor R5, and the signal is returned to ground through capacitor C2. Capacitors C2 and C17 with resistors R6 and R32 form a network to provide additional filtering for the plate of V1A.

(2) The signal is fed to the grid of the first voltage amplifier, V1B, through coupling capacitors C3 and C5 and the isolating network consisting of capacitor C4 and resistor R8. R7 is a potentiometer and serves as the MIC GAIN control. Capacitor C4 provides a low-reactance path for the high frequencies; resistor R8 prevents grounding of the reproducer signal when R7 is adjusted to its minimum position.

(3) The path of the microphone signal through the remainder of the amplifier from V1B is identical to the path of the reproducer signal described in *a*(3) through (6) above.

47. Power Supply Circuit (fig. 15)

a. D-c plate voltage for the amplifier tubes is furnished by a full-wave, rectifier power supply circuit. One Tube JAN–5Y3GT, V5, is the rectifier tube used in the circuit.

b. A-c voltage from an external source is conducted through the power cable to P3 on the control panel of the amplifier-turntable unit. From this receptacle the a-c voltage passes through power switch S1 and through fuse F1 which protects the amplifier against internal shorts and overloads. When the TONE-POWER OFF switch is turned on and the voltage selector switch S3 is in its proper position, a-c voltage is applied to the two primary windings of transformer T3. For 115-volt operation, the two primary windings are connected in parallel by switch S3; for 230-volt operation the two primary windings are connected in series. Capacitors C19 and C20 are connected on each side of the power transformer input line to minimize hum or noise from the line.

c. Transformer T3 has three secondary windings. A 6.3-volt secondary (secondary 3) steps down the a-c line voltage to 6.3 volts for the filaments of tubes V4, V3, V2, and V1, and for the filaments of the POWER pilot light. A high-voltage secondary (secondary 2) which steps up a-c line voltage is connected to plates of V5 (rectifier Tube JAN–5Y3GT). This tube rectifies high a-c voltage and delivers a pulsating d-c voltage to the filter network. A second low-voltage winding steps down the a-c line voltage for the filaments of V5.

d. Capacitors C14, C15, and C16 with resistors R26, R27, R28, and R29 form the filter network to smooth out fluctuations in the d-c voltage output. Resistors R26 and R27 lower the d-c voltage to a value required for the screen grids of the power amplifiers. The d-c voltage for the plates of the power amplifiers is furnished through the center tap of the primary of transformer T2. Resistors R28 and R29 serve as the bleeder of the power supply. Resistor R30 is screwdriver-controlled and is used to minimize hum and to provide electrical center for the amplifier tube heaters.

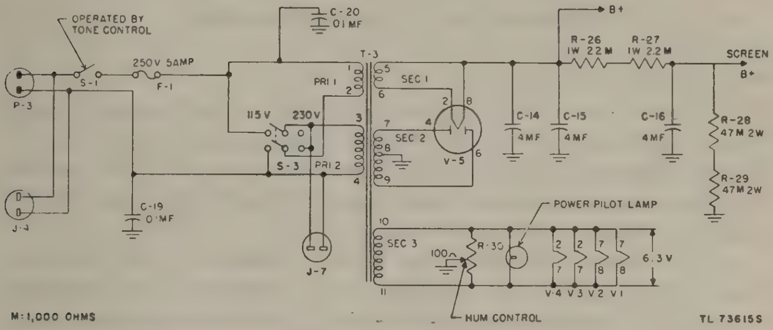


Figure 15. Power supply, schematic diagram.

48. Detailed Mechanical Analysis

a. TURNTABLE DRIVE MOTOR. (1) The drive motor supplies the necessary power for rotating the turntable. The motor is a shaded-pole, single-phase, squirrel-cage, induction type and is rubber mounted to absorb vibration. Laminated bakelite gears inclosed in oil are used to change the speed of the turntable from 33⅓ to 78 rpm. The turntable-supporting washer rests on the drive shaft pin and is held in place by grooves. The turntable is isolated from motor vibrations by a rubber disk or washer which also serves to transmit the rotation of the shaft to the turntable.

(2) Turntable speeds of 33⅓ or 78 rpm are selected through the speed change lever by providing the proper gear ratio. Regulation of speed above or below the approximate selected speed is obtained through the speed regulator lever by varying the pressure on the governor friction felt. Exact speed of 78 or 33⅓ rpm can be obtained with the use of the stroboscope equipment (sec. XIII).

(3) Power for the motor is obtained from receptacle J7 which in turn is connected across primary 2 of power transformer T3. The power switch S1 must be closed before the motor B1 can be turned ON or OFF by switch S2.

b. REPRODUCER EQUIPMENT. (1) The reproducing pick-up head is of the crystal type, using an alloy needle of the replaceable type.

(2) The reproducer arm, in which the crystal pick-up head is mounted, has freedom of motion in both horizontal and vertical planes. The reproducer arm is isolated from its mounting support by a rubber grommet to prevent transmitting of motor vibration to the crystal.

Section XI. Trouble Shooting

49. General

No matter how well equipment is designed and manufactured, faults occur in service. When such faults occur, the repairman must locate and correct them as rapidly as possible. This section contains general information to repair personnel engaged in the important duty of trouble shooting.

a. TROUBLE-SHOOTING DATA. Take advantage of the material supplied in this manual to help in the rapid location of faults. Consult the following trouble-shooting data when necessary:

(1) Detailed block diagram of Reproducing Equipment MC–364–D (fig. 14).

(2) Complete schematic diagram (fig. 25).

(3) Simplified and partial schematic diagrams (fig. 15). These diagrams are particularly useful in trouble shooting because the repairman can follow the electrical functioning of the circuits more easily than on the regular schematics, thus speeding trouble location.

(4) Voltage and resistance data for all socket connections (figs. 16 and 17).

(5) Illustrations of components. Front, top, and bottom views which aid in locating and identifying parts (figs. 6, 12, and 18 through 22).

(6) Connections on sockets, plugs, and receptacles are numbered or lettered on the various diagrams.

(*a*) Seen from the bottom, tube pin connections are numbered in a clockwise direction around the sockets. On octal sockets, the first pin clockwise from the keyway is the No. 1 pin.

(*b*) Connectors and receptacles are numbered on the side to which the associated connector is attached. To avoid confusion, some individual pins are identified by letters which appear directly on the connector.

b. TROUBLE-SHOOTING STEPS. The first step in servicing the defective reproducing equipment is to sectionalize the fault. Sectionalization means tracing the fault to the component or circuit responsible for the abnormal operation of the equipment. The second step is to localize the fault. Localization means tracing the fault to the defective part responsible for the abnormal condition. Some faults such as burned-out resistors, burned-out capacitors, and shorted transformers can be located by sight or smell. The majority of faults, however, must be located by checking voltage and resistance.

c. SECTIONALIZATION. Careful observation of the performance of the reproducing equipment during operation often sectionalizes the fault. Careful observation of the electrical and mechanical components often determines the section at fault.

d. LOCALIZATION. A localization chart is given in paragraph 55. This trouble-shooting chart lists abnormal symptoms and their probable causes. The chart also gives the procedure for determining which of the probable locations of the fault is the exact one. In addition, figures 16 and 17 show the resistance and voltage at every tube socket pin connection.

e. VOLTAGE MEASUREMENTS. Voltage measurements are an almost indispensable aid to the repairman, because most troubles either result from abnormal voltages or produce abnormal voltages. Voltage measurements are taken easily, because they are always made between two points in a circuit and the circuit need not be interrupted.

(1) Unless otherwise specified, the voltages listed on the voltage charts are measured between the indicated points and ground (chassis).

(2) Always begin by setting the voltmeter on the highest range so that the voltmeter will not be overloaded. Then, if it is necessary to obtain increased accuracy, set the voltmeter to a lower range.

(3) In checking cathode voltage, remember that a reading can be obtained when the cathode resistor is actually open. The resistance of the meter may act as a cathode resistor. Thus, the cathode voltage may be approximately normal only as long as the voltmeter is connected between cathode and ground. Before the cathode voltage is measured, make a resistance check with a cold circuit to determine whether the cathode resistor is normal.

f. VOLTMETER LOADING. It is essential that the voltmeter resistance be at least 10 times as large as the resistance of the circuit across which the voltage is measured. If the voltmeter resistance is comparable to the circuit resistance, the voltmeter will indicate a voltage lower than the actual voltage present when the voltmeter is removed from the circuit.

(1) The resistance of the voltmeter on any range can always

be calculated by the following simple rule: Resistance of the voltmeter equals the ohms per volt multiplied by the full-scale range in volts. For example: The resistance of a 1,000-ohms-per-volt meter on the 300-volt range is 300,000 ohms (R = 1,000 ohms per volt times 300 volts = 300,000 ohms).

(2) To minimize the voltmeter loading in high-resistance circuits, use the highest voltmeter range. Although only a small deflection will be obtained (possibly only 5 divisions on a 100-division scale), the accuracy of the voltage measurement will be increased. The decreased loading of the voltmeter will more than compensate for the inaccuracy which results from reading only a small deflection on the scale of the voltmeter.

(3) When a voltmeter is loading a circuit, the effect can always be noted by comparing the voltage reading on two successive ranges. If the voltage readings on the two ranges do not agree, voltmeter loading is excessive. The reading (not the deflection) on the highest range will be greater than that on the lowest range. If the voltmeter is loading the circuit heavily, the deflection of the pointer will remain nearly the same when the voltmeter is shifted from one range to another.

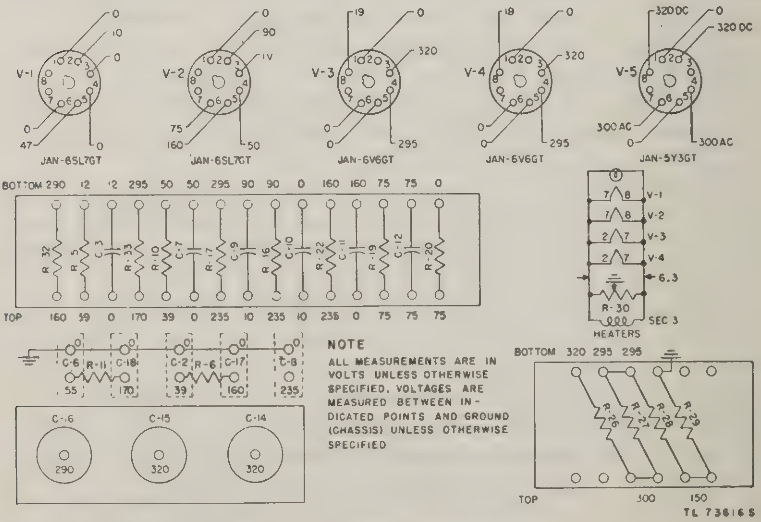

V-1
JAN-6SL7GT
V-2
JAN-6SL7GT
V-3
JAN-6V6GT
V-4
JAN-6V6GT
V-5
JAN-5Y3GT
320 DC
300 AC
BOTTOM 290 12 12 295 50 50 295 90 90 0 160 160 75 75 0
R-32 R-5 C-3 R-33 R-10 C-7 R-17 C-9 R-16 C-10 R-22 C-11 R-19 C-12 R-20
TOP 160 39 0 170 39 0 235 10 235 10 235 0 75 75 75
C-6 R-11 C-18 C-2 R-6 C-17 C-8
55 170 39 160 235
C-16 C-15 C-14
290 320 320
NOTE
ALL MEASUREMENTS ARE IN VOLTS UNLESS OTHERWISE SPECIFIED. VOLTAGES ARE MEASURED BETWEEN INDICATED POINTS AND GROUND (CHASSIS) UNLESS OTHERWISE SPECIFIED
V-1 V-2 V-3 V-4
6.3
R-30
HEATERS
SEC 3
BOTTOM 320 295 295
R-26 R-27 R-28 R-29
TOP 300 150
TL 73616 S

Figure 16. Voltage measurements.

50. Resistance Measurements

a. NORMAL RESISTANCE VALUES. When a fault develops in a circuit, its effects are often apparent as a change in the resistance value. To assist in the localization of such faults, trouble-shooting data, including the normal resistance values, have been provided. The normal resistance values at any point in the circuit may be determined by reference to the schematic diagrams and the resistance measurements chart. Values of resistors may be determined by use of the resistor color codes (figs. 23 and 24).

b. PRECAUTIONS. (1) Turn off the power before making any resistance measurements. An ohmmeter is essentially a low-range voltmeter and battery. If the ohmmeter is connected to a circuit which already has voltages in it, the needle will be thrown off scale and the voltmeter movement may be burned out.

(2) Capacitors must always be discharged before resistance measurements are made. This is very important when checking power supplies that are disconnected from their load. The discharge of a capacitor through the meter may burn out its movement.

c. CORRECT USE OF LOW AND HIGH RANGES. Make certain when to use the low-resistance range and when to use the high-resistance range of an ohmmeter. When checking the circuit continuity, the ohmmeter should be set on the lowest range. If a medium or high range is used, the pointer may indicate 0 ohms, even if the resistance is as high as 500 ohms. When checking high resistances, or when measuring the leakage resistance of capacitors or cables, the highest range should be used. If a low range is used, the pointer will indicate infinite ohms, even though the actual resistance is less than a megohm.

d. PARALLEL RESISTANCE MEASUREMENTS. (1) In a parallel circuit, the total resistance is less than the lowest resistance in the circuit.

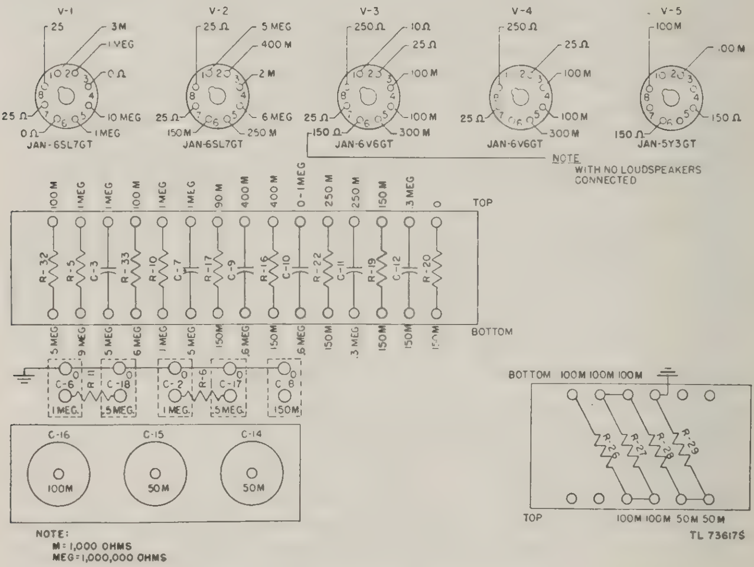
(2) When the resistance is measured and the value is found to be less than expected, study the schematic diagram carefully to be certain that there are not resistances in parallel with the one that has been measured. Before replacing a resistor because its resistance measures too low, disconnect one terminal from the circuit and measure its resistance again, to make sure that the low reading does not occur because some part of the circuit is in parallel with the resistor.

e. TOLERANCE VALUE FOR RESISTANCE MEASUREMENTS. Tolerance means the normal difference that is expected between the rated value of the resistor and its actual value.

(1) Most resistors used in the circuits have a tolerance of at least 10 percent. For example, the grid resistor of a stage might have a rated value of 1 megohm. If the resistor were measured and found to have a value between 0.9 megohm and 1.1 megohms, it would be considered normal. Usually, the ordinary resistors

used in circuits are not replaced unless their values are off more than 10 percent.

(2) The tolerance values for transformer windings are generally between 1 and 5 percent. As a rule, suspect a transformer which shows a resistance deviating more than 5 percent from its rated value. Allow the transformer to cool before the resistance test is made.



NOTE
WITH NO LOUDSPEAKERS
CONNECTED

NOTE:
M=1,000 OHMS
MEG=1,000,000 OHMS

Figure 17. Resistance measurements.

51. Capacitor Checks

a. CAPACITOR DEFECTS. It is often necessary and desirable to check capacitors for leakage and open or shorted circuits. Although sometimes open circuits occur in paper-type capacitors, because of the metal tab pulling away from the tinfoil plates, this trouble is unusual. The usual trouble in a capacitor is a short circuit or leakage caused by the break-down of the dielectric between the plates.

b. OPEN CAPACITOR. A capacitor suspected of being open can best be checked by shunting a good capacitor across it. In audio-frequency circuits, the test capacitor leads may be several inches long without materially affecting the circuit of which the capacitance is a part.

c. KICK INDICATION. Any good high-resistance voltohmmeter may be used to check for leakage in a paper or mica capacitor.

Tests for an open and short circuit may be made with the same instrument. (Test Unit I–176 is generally available in the field and is recommended for checking capacitors, using the kick-indication method.) The ohmmeter circuit of the test unit is used to make the check. Proceed as follows:

(1) Disconnect one end of the capacitor from its shunting circuit.

(2) Set the ohmmeter to read on its highest range, and place the ohmmeter leads across the capacitor.

(3) A good capacitor should cause the needle to kick up the scale and fall back to infinity (zero).

(4) A leaky capacitor will cause the needle to remain at some point on the scale other than infinity.

(5) An open capacitor will cause no deflection of the needle.

(6) The lower the capacitance, the lesser will be the degree of deflection which occurs on the ohmmeter scale. The higher the capacitance, the greater will be the deflection which appears on the ohmmeter scale (if the capacitor is normal). Usually capacitors lower than 0.05 microfarad (mf) do not indicate a measurable kick. Replace defective capacitors.

d. CAPACITOR COLOR CODE. An illustration of the capacitor color code is given in figure 24.

52. Tube Checking

The trouble shooter is mostly concerned with the emission of a vacuum tube. Hand-tapping of the tube envelope usually reveals shorted or poorly welded elements inside the tube. Such tubes, when tapped while under operation, usually result in scratchy noises in the speaker. Experience in tapping tube envelopes will teach the trouble shooter how to isolate the defective tube or tubes.

a. Results obtained from a tube checker are not always conclusive because the test conditions are not the same as those under which the tubes actually operate in the amplifier. The final test of a tube may have to be its replacement with a tube known to be good.

b. Tube checkers are usually available in the field. Technical manuals are packed with the instruments, and they include the tube-checker-panel settings for all types of tubes used in the reproducing equipment.

53. Current Measurements

a. Current measurements ordinarily are not required in trouble shooting the set. However, if it is desired to measure the plate current of a tube or rectified current in the power supply, the circuit may be opened and the meter connected in series with the circuit. Observe polarity to keep the meter needle on the scale. *A milliammeter must always be connected in series with the circuit under check.*

b. A meter is least protected against damage when it is used to measure current; therefore always set the current range to the highest value. Then, if necessary, decrease the range to give a more accurate reading. Avoid working close to full-scale reading because this increases the danger of overload.

c. Usually the current to be measured flows through a resistance which is either known or can be measured with an ohmmeter. The current flowing in the circuit can be determined by dividing the voltage drop across the resistor by its resistance value.

54. Sectionalizing Trouble in Reproducing Equipment MC–364–D

Symptoms	Probable trouble	Corrections
1. Reproducer dead. POWER pilot lamp out.	1. Power supply not connected. Defective fuse. Defective power transformer. Defective switch. Defective power supply cable.	1. Check power source. Replace fuse. Replace power transformer. Replace switch. Replace power supply cable.
2. POWER pilot lamp dim.	2. Voltage selection switch S3 in wrong position.	2. Check switch position.
3. Turntable will not rotate.	3. Defective motor or coupling. Gears jammed. Lubricant stiff because of low temperatures.	3. Check for binding parts. Check position of speed controls. Allow the equipment to warm up.
4. No signal in loudspeaker when disk is played.	4. Loose connections. Defective amplifier. Defective reproducing head. Defective loudspeaker.	4. Check all connections. Check amplifier voltages and tubes. Replace reproducing head (par. 57*c*). Replace loudspeaker (par. 57*d*).
5. No signal in loudspeakers when microphone is used.	5. Defective microphone or microphone cord. Loose connections.	5. Test the equipment on reproduction; if operative, trouble exists before MIC GAIN control. Check microphone cord and connections. Replace microphone.

Symptoms	Probable trouble	Corrections
6. Quality of reproduction unsatisfactory.	6. Defective record.	6. Discard record.
	Defective needle.	Replace needle.
	Defective reproducing head.	Replace reproducing head (par. 57*c*).
	Defective amplifier.	Check tubes and voltages.
	Open shield or wire to input circuit.	Resolder ground connections. Restore shield.
	Defective tubes.	Replace tube.
	Defective coupling capacitors C3, C5, C7, C9, C12, and C11.	Replace capacitors.
	Low line voltage.	Check for excessive load on line and remove if possible.
	Defective loudspeaker.	Replace loudspeaker.
7. Frequent blowing of fuse.	7. Defective transformer T3.	7. Replace transformer.
	Fuse rating below 5 amp.	Use 5-amp fuse only.
	C14, C15, or C16 shorting intermittently.	Replace capacitors.
	Defective rectifier Tube JAN 5Y3GT.	Replace tube.
	Short-circuited motor or wiring.	Check motor and switch wiring for a short circuit.
8. Howling from loudspeaker.	8. Defective Tube JAN 6SL7GT (V1).	8. Tap tube to determine if faulty.
	Microphone too close to loudspeakers.	Place microphone as far from loudspeakers as possible.
	MIC GAIN control too high for operating conditions.	Lower MIC GAIN control. Attentuate high frequencies by adjusting tone control.

55. Localizing Trouble in Reproducing Equipment MC–364–D.

Symptoms	Probable trouble	Corrections
1. Microphone dead; no output signal.	1. Poor connections or short in cord.	1. Repair cord.
2. Reproducer operates, but no signal from microphone.	2. Poor tube; V1A inoperative. Open resistor R5, R7, R6, or R32. Shorted capacitor C3, C2, or C17.	2. Replace V1. Replace resistor. Replace capacitor.
3. Reproduced head inoperative.	3. Broken crystal. Open circuit in wiring or connector P1.	3. Replace crystal cartridge. Check wiring and connector.
4. Microphone signal available to first voltage amplifier, but no signal from reproducer head.	4. Open resistors R1, R2. (See 3 above.)	4. Replace resistors.
5. Both reproducer and microphone signal available to first voltage amplifier but not beyond.	5. Poor tube; V2A inoperative. Open resistors R10, R11, R33. Open or shorted capacitors C7, C6, C18.	5. Replace tube V2. Replace resistor. Replace capacitor. Check continuity.
6. Microphone signal or reproducer signal available to second voltage amplifier but not beyond.	6. Poor tube; V2B inoperative. Open resistors R13, R14, R16, R17. Open or shorted capacitors C8 and C9.	6. Replace tube V2. Replace resistor. Replace capacitor. Check continuity.
7. Signal available to phase inverter but not beyond.	7. Poor tube; V2B inoperative. Open resistors R18, R19, R20, R22. Open or shorted capacitors C11, C12.	7. Replace tube. Replace resistor. Check continuity. Replace capacitors.

Symptoms	Probable trouble	Corrections
8 Signal available to power amplifier but not beyond.	8. Defective tubes V3 and V4.	8. Replace tubes.
	Open resistors R23, R24, R25.	Replace resistors.
	Defective capacitors C11, C12.	Replace capacitors.
	Defective transformer T2.	Replace transformer.
	Open circuit in speaker wiring.	Check continuity.
9. Power supply; no output voltage.	9. Defective tube V5.	9. Replace tube.
	Open resistors R26, R27.	Replace resistor.
	Shorted capacitors C14, C15, C6.	Replace capacitors.
	Defective power transformer T3.	Replace transformer.
	Open circuit in power cable.	Check continuity.
	Blown fuse.	Replace fuse.
	Defective voltage-selector switch.	Replace switch.

Section XII. REPAIRS

56. General

Repairs to Reproducing Equipment MC–364–D consist mainly of the following operations: replacement of parts (par. 57); tightening loose mountings for transformers, resistors, and capacitors; splicing and repairing defective cords; straightening bent pins on connectors; tightening setscrews on all control knobs; removing corrosion from those points in the circuit which, if corroded, would interfere with normal operation. Techniques of tightening and cleaning are discussed in section VI. All wires used in the reproducing equipment are color-coded for rapid identification of circuits; reference symbols shown on the schematic diagram (fig. 25) are stamped on the various items.

57. Replacement of Parts

a. General. Mounting screws for sockets, capacitors, transformers, and connectors are accessible and easily removed. When replacing a part, note the colors of wires and attach identification tags, if necessary, to the free ends of wires or terminals. Always reinstall parts and wires in exactly the position originally held. Always use identical replacement parts and always use the same ground lug for the ground connection. Avoid heating wires or adjacent parts with the soldering iron. Avoid dropping solder on the chassis by keeping the tip of the iron well tinned and away from the chassis when the iron is loaded with molten solder. Collect all wire strands and cut off or place alongside the main body of the wire and solder securely.

b. Replacement of Needle. (1) Use the screwdriver supplied or any other screwdriver of suitable size, and loosen the two screws that secure the reproducer head in place.

(2) Loosen the needle clamping setscrew, and remove the defective needle.

(3) Insert the blunt end of the replacement needle into the hole. Push the needle up as far as it will go, and then tighten the setscrew.

(4) Replace the head in the reproducer arm.

c. Replacement of Reproducer Head. (1) Use the screwdriver supplied or any other screwdriver of suitable size, and loosen and remove the two screws that hold the reproducer head in place.

(2) Unsolder the leads from the terminals of the reproducer head (*a* above).

(3) Resolder the leads to the replacement reproducer head.

(4) Install the new reproducer head in the reproducer arm, and tighten mounting screws in place.

d. REPLACEMENT OF LOUDSPEAKERS. (1) Remove the four nuts which hold the loudspeaker frame to the loudspeaker housing case.

(2) Unsolder all leads to the loudspeaker (*a* above).

(3) Install a new loudspeaker in place, replace and tighten the four nuts, and resolder all leads.

e. REPLACEMENT OF MOTOR. (1) Remove the C spring washer, and then remove the turntable.

(2) Disconnect the motor power cable.

(3) Loosen the two wingnuts and remove the U-shaped motor support bracket.

(4) Loosen the four screws that hold the mounting brackets to the deck panel, and remove the metal reinforcement bars on the under side of the deck panel.

(5) Remove the motor.

(6) Install the replacement motor by reversing the procedure for removing it.

f. REPLACEMENT OF CAPACITORS. (1) To replace any one of capacitors C1, C3, C7, C9, C11, C12, or C20, unsolder the two leads to the capacitor, secure a replacement capacitor in place, and resolder the two leads. Allow leads no longer than those used on the original capacitor.

(2) To replace any one of capacitors C14, C15, or C16, proceed as follows:

(*a*) These capacitors are secured in place on the chassis by means of a bracket held in place by two screws and nuts. Remove the nuts and brackets.

(*b*) Unsolder the leads to the capacitor.

(*c*) Remove the defective capacitor and secure a replacement in position by means of the bracket and two nuts.

(*d*) Resolder the leads to the capacitor.

(3) Capacitors C2, C6, C8, C17, C18, C13, and C19 are secured to the chassis by means of two nuts. Capacitors C2, C6, C8, C17, and C18 are also provided with straps.

(*a*) Remove the nuts which hold the capacitor to the chassis.

(*b*) Unsolder the leads to the capacitor, and remove the defective capacitor.

(*c*) Secure a replacement capacitor in place, resolder the leads in their proper positions, replace the straps where necessary, and tighten the two holding nuts.

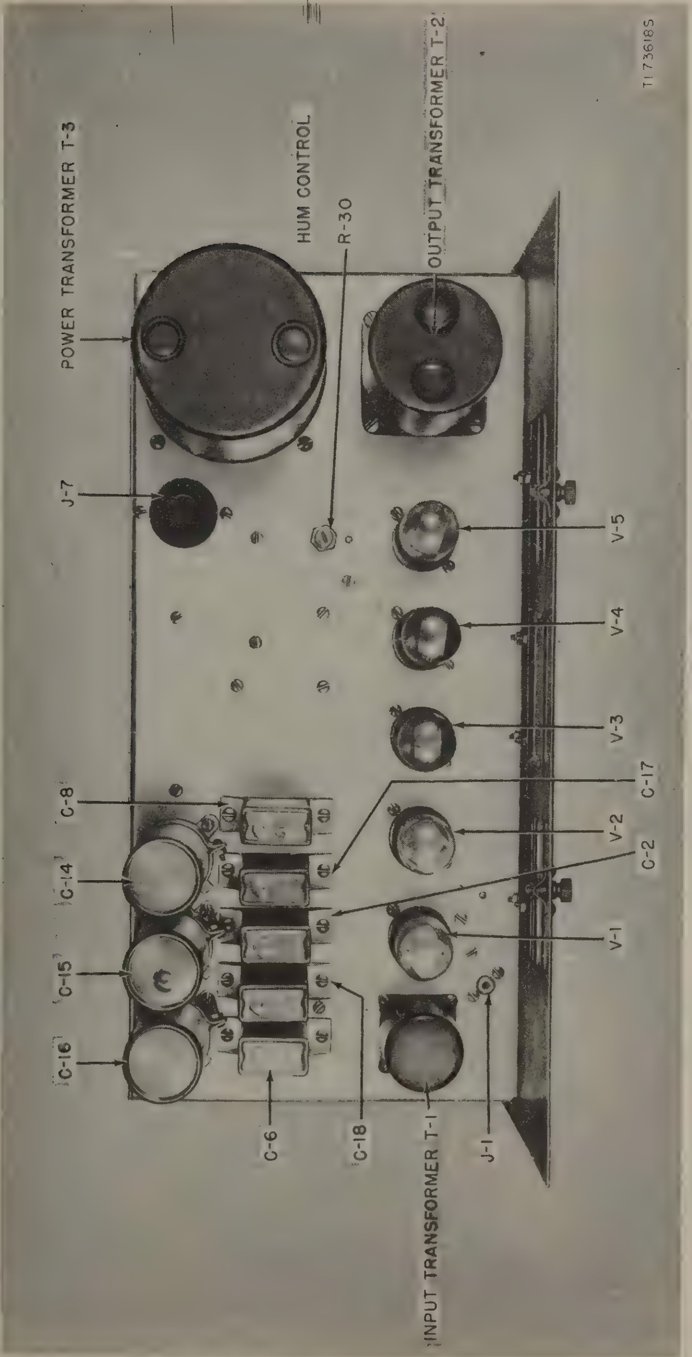


Figure 18. Amplifier chassis, top view.

g. REPLACEMENT OF TRANSFORMERS. The input, output, and power transformers (T1, T2, and T3 respectively) are each held in position by means of four nuts. To replace a transformer, proceed as follows:

(1) Remove the screws and bolts which secure the amplifier-turntable unit to the housing, and then remove the unit.

(2) Unsolder and label all leads to the transformer.

(3) Remove the four nuts which hold the transformer to the chassis.

(4) Remove the transformer, secure a replacement in position with the four nuts, and resolder the leads to their original positions.

(5) Secure the amplifier-turntable unit in its housing.

h. REPLACEMENT OF SWITCHES. (1) Unsolder all leads to the switch; tag all leads.

(2) Remove the locknut which holds the toggle switch to the deck panel and to the control panel.

(3) Remove the switch, make a replacement, secure in position with the locknut, and resolder the leads in place.

i. REPLACEMENT OF GAIN CONTROLS (POTENTIOMETERS). (1) Loosen the setscrew which holds knob on the control shaft. Remove the knob.

(2) Remove the nut which holds the gain control to the panel.

(3) Unsolder and label all leads to the gain control.

(4) Remove the defective gain control, and secure the replacement (potentiometer) in place by reversing the procedure for removing it. Adjust position of control knob to 0 position at maximum counterclockwise rotation.

58. Disassembly and Lubrication of Turntable Unit
(figs. 20, 21, and 22)

The turntable motor should be lubricated through the three oil holes once monthly as described in paragraph 38. However, when the motor must be disassembled for repairs, inspect the gears, wicks, and speed-control assembly for dirt and hard grease. If necessary, clean and lubricate.

a. DISCONNECTING MOTOR FROM DECK PANEL. (1) Remove the turntable unit from the housing case by removing the 11 mounting screws from the deck panel and lifting the panel from the housing.

(2) Remove the modified C washer which holds the turntable on the spindle; lift off the turntable (fig. 13).

(3) Turn the unit over and disconnect the speed control and shifting levers.

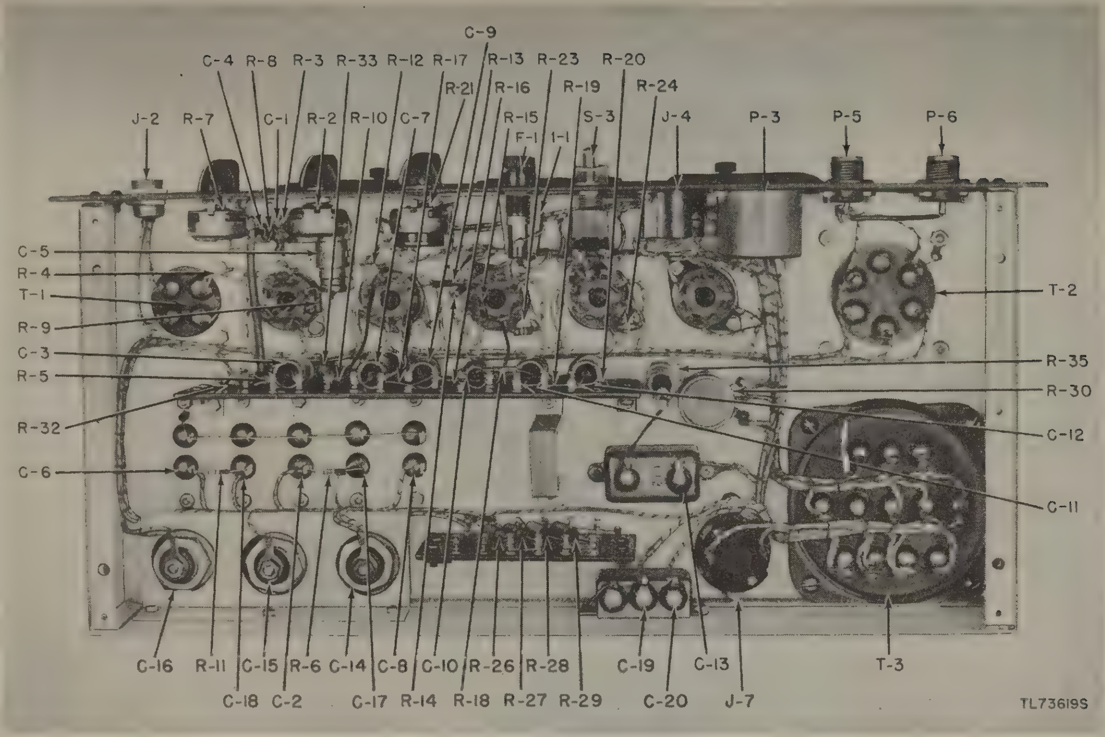


Figure 19. Amplifier chassis, bottom view.

(4) Remove the motor assembly from the panel (par. 57*e*). Remove the four screws which hold the mounting brackets to the motor assembly.

b. Gearcase Disassembly and Lubrication. (1) Remove the four screws from the gearcase top cover and lift off the cover. Use caution when lifting the cover to prevent damage to the paper gasket.

(2) Pull out the low-speed (33⅓ rpm) gear assembly. The low-speed gear consists of two helical gears mounted on a shaft (fig. 20).

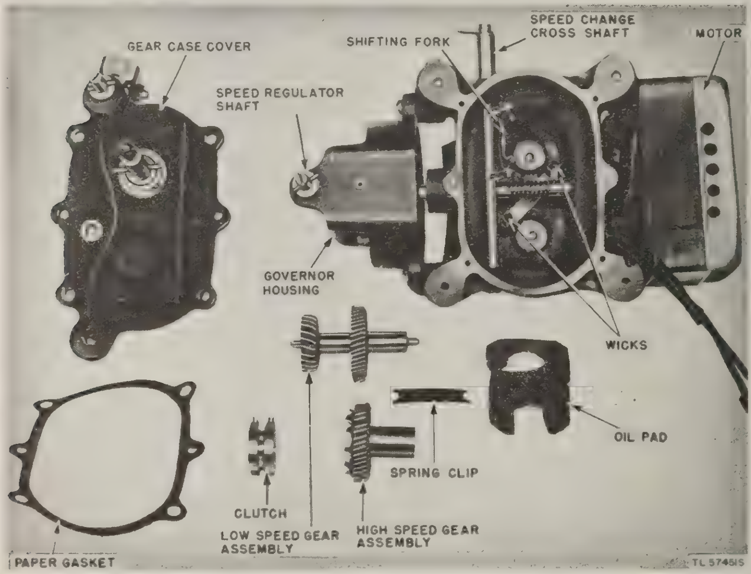


Figure 20. Phono motor parts.

(3) Lift up the shifting fork and remove the clutch from the fork.

(4) Pull out the high-speed (78-rpm) gear. The high-speed gear is a single helical gear mounted on a shaft.

(5) Remove the key from the turntable-drive spindle, and pull the spindle out of the hub of the reduction gear.

(6) Remove the two small screws from the collar holding the reduction gear, and lift off the collar and thin washer (fig. 21). Slide the gear out of the bearing.

(7) Pry out the flat steel spring which holds the oil pad to the

bottom of the gearcase. Lift out the oil pad. Rotate the bracket which holds the two wicks and remove the wicks (fig. 20).

c. CLEANING AND LUBRICATING GEARS. (1) Clean all parts with a stiff brush and solvent (SD) and allow to dry.

(2) Reinstall the oil pad and wicks in the bottom of the gearcase. Rotate the wick bracket to its original position. Insert the flat steel spring, and press down evenly so that the felt oil pad is held tightly.

(3) Saturate the oil pad with oil (PL SPECIAL).

(4) Apply a light coat of grease (GL) to the gear teeth of the gear assemblies, and insert in place in the gearcase.

(5) Apply a light coat of grease (GL) to the hub of the reduction gear, and reassemble to the top cover.

(6) Apply a light coat of grease (GL) to the bearing surfaces of the turntable drive spindle, and insert the spindle into the hub of the reduction gear. Carefully replace the key in the spindle to prevent burring. Slide the clutch over the key to insure that there is no binding. If the key has become burred, remove the burr with a fine file and wipe clean. Reinsert the spindle in the clutch.

(7) Apply 1 to 2 drops of oil (PL SPECIAL) to the bearing ends of the speed-change cross shaft and to the pivots of the shifting fork (fig. 20).

(8) Apply a light coat of grease (GL) to the clutch, and place on top of the high-speed (78 rpm) gear assembly. Engage the clutch with the shifting fork.

(9) Carefully reinstall the paper gasket of the top cover.

(10) Carefully reinstall the gearcase top cover to insure proper alinement of the low-speed (33⅓ rpm) gear assembly with the bearing in the top cover and the mating of the clutch to the keyed shaft of the turntable drive-spindle.

(11) Press the cover down over the gearcase, and fasten with the four screws.

(12) Apply 1 to 2 drops of oil (PL SPECIAL) to speed shift lever and shaft located on top cover of gearcase.

d. MOTOR SHAFT THRUST-BEARING DISASSEMBLY AND LUBRICATION (fig. 22). (1) Loosen the locknut of the slotted motor thrust-bearing adjustment.

(2) Unscrew the thrust bearing, and remove it from the end frame of the motor.

(3) Remove old lubricant from the thrust bearing and mating end of the motor shaft with solvent (SD). Wipe dry.

(4) Relubricate by lightly coating thrust bearing with grease (GL). Do not lubricate excessively.

(5) Reinstall the thrust bearing in the motor end frame, and tighten until no shaft end play exists. Finger tighten the locknut. To provide proper end play for the shaft, back off the thrust bearing by means of the slotted head ¼ turn, and tighten the locknut. The resulting end play of the motor shaft should be perceptible when the shaft is moved end-wise by hand.

e. SPEED CONTROL DISASSEMBLY AND LUBRICATION. (1) Remove the four screws which hold the end frame housing, the speed control, and governor.

(2) Pull off the end frame.

(3) Remove the felt oil pad from the cup; clean the pad and cup with solvent (SD).

(4) Clean the friction disk and springs of the governor with solvent (SD). Use a stiff bristled brush.

(5) Reinstall oil pad in cup, and saturate with oil (PL SPECIAL). Do not apply more oil (PL SPECIAL) than necessary to insure saturation of the oil pad.

(6) Apply 1 drop of oil (PL SPECIAL) to the pivots of the governor springs.

(7) Reassemble the end frame to the motor assembly.

(8) Apply 1 or 2 drops of oil (PL SPECIAL) to speed-control cam and shaft located on top of end frame.

Note. Do not disturb position of governor assembly on main shaft.

(9) Reassemble the motor assembly to the panel.

(10) Connect the speed control and shifting gears.

(11) Test the operation of the unit for the proper speeds at 78 rpm and 33⅓ rpm.

59. Emergency Repairs

Trouble may exist in the reproducing equipment at a time when the equipment is most vitally needed. By becoming familiar with the troubleshooting charts in this manual, the operator may be able to sectionalize the fault to a specific part. The following emergency repairs may be made, when applicable, to keep the equipment in operation until the equipment can be serviced properly.

a. If the turntable fails to rotate, move the speed regulator lever in and out of position. This permits the gears of the turntable drive to mesh or may reset the gears in the event that they are jammed. Do this while the power to the motor is on.

b. Check the jack from the reproducer to the chassis. Since this is a friction-type jack, it may have become disconnected while in transit.

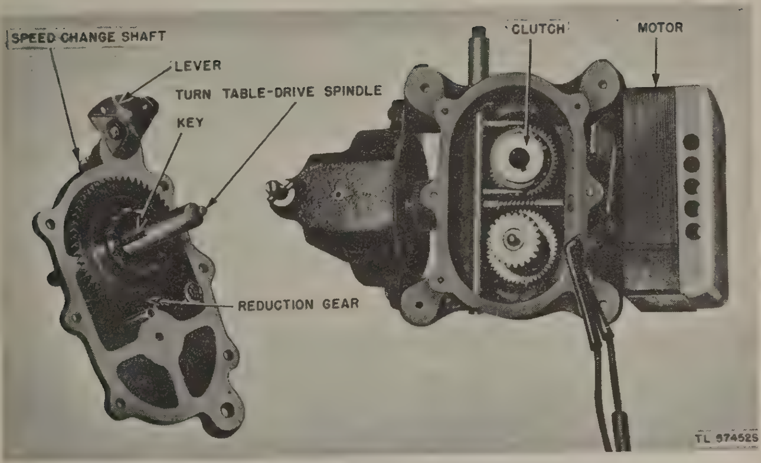


Figure 21. Phono motor gearcase, disassembled.

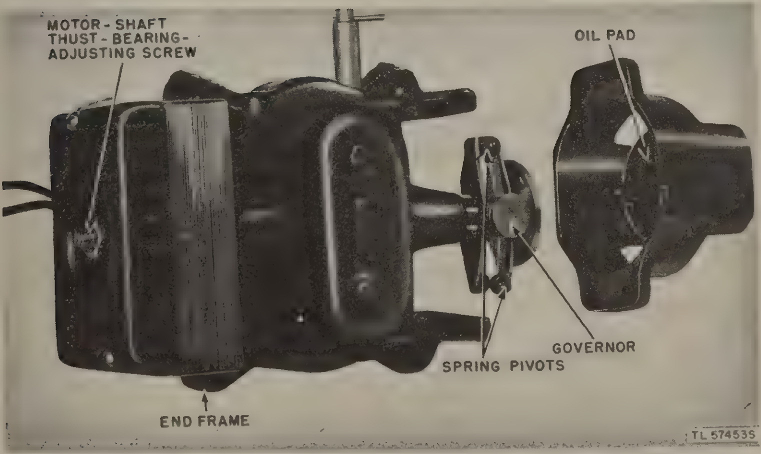


Figure 22. Phono motor governor and thrust-bearing-adjustment screw.

60. Repainting

When the finish on the case has been badly scratched or damaged, rust and corrosion can be prevented by touching up marred surface as follows:

a. Use No. 00 or No. 000 sandpaper to clean the surface down to the bare metal. Obtain a bright smooth finish.

Caution: The use of steel wool, although permitting rapid removal of rust, is not recommended. Minute particles of steel wool frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. Apply paint, O.D. (stock No. 6G1506.3), with a small brush (stock No. 6Z1558 or equal).

61. Unsatisfactory Equipment Report

a. WD AGO FORM 468 (WAR DEPARTMENT UNSATISFACTORY REPORT) FOR EQUIPMENT USED BY ARMY GROUND FORCES AND TECHNICAL SERVICES. WD AGO Form 468 will be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D. C., when trouble occurs more often than is normal, as determined by qualified repair personnel.

b. AAF FORM 54 (UNSATISFACTORY REPORT) FOR EQUIPMENT USED BY ARMY AIR FORCES. AAF FORM 54 will be filled out and forwarded to Commanding General, Air Matériel Command, Wright Field, Dayton, Ohio, in accordance with AAF Regulations 15–54.

Section XIII. TURNTABLE SPEED ADJUSTMENTS

62. Adjusting 78-rpm Speed

Place the stroboscope disk on the turntable. The innermost ring on the stroboscope is used with a power input frequency of 50 cycles and its adjacent ring is used with a frequency of 60 cycles.

b. Connect the neon lamp to the utility OUTLET, J4, and hold the lamp over the ring corresponding to the input frequency (*a* above).

c. Turn the TONE-POWER OFF switch clockwise until the power switch is in on position.

d. Throw the MOTOR ON-OFF switch to the ON position.

e. Move the speed change lever to the 78-rpm position.

f. Using the neon lamp, observe the pattern on the stroboscope disk. If the turntable is rotating too fast or too slowly, the stroboscope pattern appears to rotate clockwise or counterclockwise.

Adjust the speed regulator lever until the stroboscope pattern appears stationary.

63. Adjusting 33 1/3-rpm Speed

a. Place the stroboscope disk on the turntable. The outermost ring on the stroboscope disk is used when the power source is 60 cycles while its adjacent circle is used with a power source of 50 cycles.

b. The procedure for adjusting 33⅓-rpm speed is identical with that given for adjusting for 78-rpm speed (par. 62) except that the speed change lever is moved to the 33⅓-rpm position and the lamp is held over one of the two outer rings.

64. Adjusting 78 rpm When Input Frequency Is Between 50 and 60 Cycles

When the power source has a frequency between 50 and 60 cycles, the method described in paragraph 62 cannot be used to adjust for 78 rpm. Proceed as follows:

a. Note the white mark index on the rim of the turntable.

b. Turn the power and motor switches to their on positions.

c. Move the speed change lever to the 78-rpm position.

d. Use a stop watch (or a watch with a second hand), and count the number of turntable revolutions per time interval in seconds.

e. If the number of revolutions for a selected time interval in seconds is less than the number indicated in the table below, move the speed regulator lever towards its F position. If the number of revolutions is greater than the number indicated in the table, move the speed regulator lever towards its S position. The turntable speed is correct when the number of revolutions per time interval checked corresponds to the number of revolutions indicated in the table for the selected time intervals.

REVOLUTIONS PER TIME INTERVAL IN SECONDS (78 RPM)

Time intervals	*Number of revolutions*
10	13
20	26
21.5	28
27	35
30	39
40	52
50	65
60	78

65. Adjusting 33 1/3 rpm When Input Frequency Is Between 50 and 60 Cycles

When the power source has a frequency between 50 and 60 cycles, the method described in paragraph 63 cannot be used to adjust for 33⅓ rpm. Follow the procedure given in paragraph 64 for adjusting 78-rpm speed when the input frequency is between 50 and 60 cycles with the following exceptions:

a. Move the speed change lever to the 33⅓-rpm position instead of to the 78-rpm position (par. 64*c*).

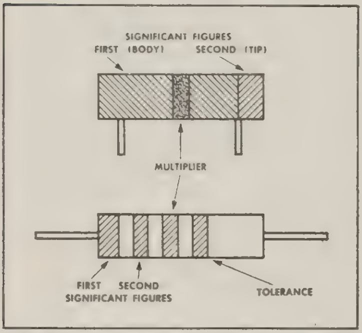
b. Use the following table instead of the one given in paragraph 64*e*.

REVOLUTIONS PER TIME INTERVAL IN SECONDS (33⅓ RPM)

Time intervals	*Number of revolutions*
18	10
27	15
36	20
45	25
54	30
60	33⅓

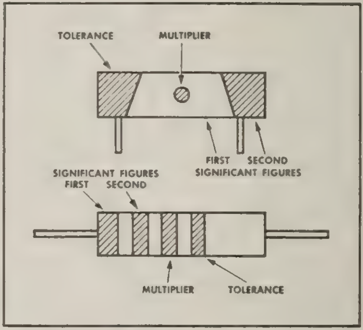
RESISTOR COLOR CODES

RMA COLOR CODE FOR
FIXED COMPOSITION RESISTORS



Insulated fixed composition resistors with axial leads are designated by a natural tan background color. Non-insulated fixed composition resistors with axial leads are designated by a black background color.

JAN COLOR CODE FOR
FIXED COMPOSITION RESISTORS



Resistors with axial leads are insulated. Resistors with radial leads are uninsulated.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	
RED	2	100	
ORANGE	3	1,000	
YELLOW	4	10,000	
GREEN	5	100,000	
BLUE	6	1,000,000	
VIOLET	7	10,000,000*	
GRAY	8	100,000,000*	
WHITE	9	1,000,000,000*	
GOLD		0.1*	5
SILVER		0.01*	10
NO COLOR			20

*JAN ONLY

Example: A 50,000-ohm resistor with a standard tolerance of 20 percent (no color) would be indicated by a green ring (5), a black ring (0), and an orange ring (000).

RMA: Radio Manufacturers Association
JAN: Joint Army-Navy

TL 13418 A

Figure 23. Resistor color codes.

JOINT ARMY-NAVY TYPE DESIGNATION CODES FOR ELECTRICAL COMPONENTS

INTRODUCTION: Fixed and variable resistors and fixed capacitors manufactured under JAN specifications may be labeled with a *type designation code* instead of a color code or actual electrical value. For resistors and capacitors marked with the JAN type designation code, electrical values and other data can be determined by consulting the following information.

RESISTORS

FIXED, COMPOSITION

RC 10 AE 153 M

COMPONENT STYLE *CHARACTERISTIC RESISTANCE *TOLERANCE

COMPONENT: RC signifies *fixed, composition resistor.*

STYLE: A two-digit symbol indicates power rating and physical size.

Resistor style	Wattage
RC10, RC15, RC16	¼ WATT
RC20, RC21, RC25	½ WATT
RC30, RC31, RC35, RC38	1 WATT
RC40, RC41, RC45	2 WATTS
RC65	4 WATTS
RC75, RC76	5 WATTS

RESISTANCE: A three-digit symbol indicates the resistance value in ohms. The first two digits give the first two figures of the resistance value; the third digit gives the number of zeros which follow the first two figures.

RESISTORS

VARIABLE, WIRE-WOUND

RA 15 A 1 RH 103 A K

COMPONENT STYLE SWITCH *TORQUE *SHAFT RESISTANCE *TAPER *TOLERANCE

COMPONENT: RA signifies *variable, wire-wound resistor.*

STYLE: A two-digit symbol indicates power rating and physical size and shape.

SWITCH: Symbol A indicates no switch. Symbol B indicates a switch turned ON at start of clockwise rotation.

RESISTANCE: A three-digit symbol indicates the resistance value in ohms. The first two digits give the first two figures of the resistance value; the final digit gives the number of zeros which follow the first two figures. The letter *R* may be substituted to represent a decimal point; but when *R* is used, the last digit of the group becomes significant.

RHEOSTATS

WIRE-WOUND, POWER-TYPE

RP 35 2 FD 252 KK

COMPONENT STYLE OFF POSITION *SHAFT RESISTANCE *TOLERANCE

COMPONENT: RP signifies all *rheostats.*

STYLE: Same as for variable, wire-wound resistors.

OFF POSITION:

Numeral	OFF position
1	None.
2	At end of counterclockwise rotation.
3	At end of clockwise rotation.

RESISTANCE: Same as for variable, wire-wound resistors.

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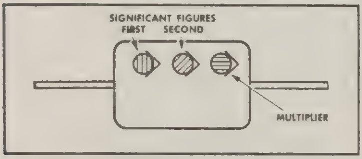
*Items starred are of interest primarily to depot and higher echelon repair personnel.

TL 18141

Figure 23—Continued.

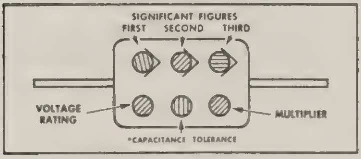
CAPACITOR COLOR CODES

RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

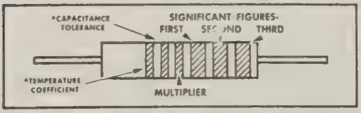


Capacitors marked with this code have a voltage rating of 500 volts.

RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS



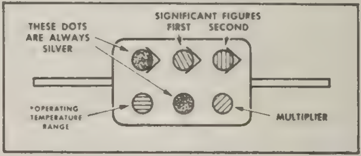
Capacitors marked with this code have a voltage rating of 500 volts.

RMA Radio Manufacturers Association JAN Joint Army Navy

Note These color codes give all capacitances in micromicrofarads

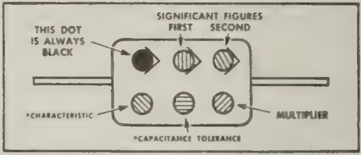
*Items marked with an asterisk are of interest primarily to depot and higher echelon repair personnel

JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



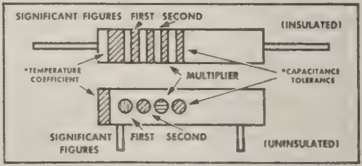
The silver dots serve to identify this marking. For working voltages see JAN type designation code

JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



The black dot serves to identify this code. For working voltages see JAN type designation code.

JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS



Capacitors marked with this code have a voltage rating of 500 volts. Either the band or dot code may be used.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000			400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD		0.1	0.1		1,000
SILVER		0.01	0.01		2,000
NO COLOR					500

TL 13417 A

Figure 24. Capacitor color codes.

CAPACITORS

FIXED, MICA-DIELECTRIC

CM	20	B	511	K
COMPONENT	CASE	*CHARACTERISTIC	CAPACITANCE	*TOLERANCE

COMPONENT: CM signifies *fixed, mica-dielectric capacitor.*

CASE: A two-digit symbol identifies a physical case size and shape.

CAPACITANCE: A three-digit symbol indicates the capacitance value in micromicrofarads. The first two digits give the first two figures of the capacitance value; the final digit gives the number of zeros which follow the first two figures. When more than two significant figures are required, additional digits may be used, the last digit always indicating the number of zeros.

D-C WORKING VOLTAGE FOR CAPACITANCE RANGE

Case	Capacitance range	Vdcw
CM20	5-510 mmf	500
CM25	5-1,000 mmf	500
CM30	470-3,300 mmf	500
CM35	470-6,200 mmf	500
	6,800-10,000 mmf	500
CM40	3,300-8,200 mmf	500
	9,100-10,000 mmf	300

NOTE: Working voltages for capacitors above CM40 are stamped on the case

The d-c working voltage of a capacitor can be determined from the above table when the case size and value of capacitance are known.

CAPACITORS

FIXED, MOLDED, PAPER-DIELECTRIC†

CN	36	A	302
COMPONENT	CASE	*CHARACTERISTIC	CAPACITANCE

COMPONENT: CN signifies *fixed, molded, paper-dielectric capacitor.*

CASE: Same as for fixed, mica-dielectric capacitors.

CAPACITANCE: A three-digit symbol indicates the capacitance value in micromicrofarads. The first two digits give the first two figures of the capacitance value; the third digit gives the number of zeros which follow the first two figures.

D-C WORKING VOLTAGE FOR CAPACITANCE RANGE

Case	Capacitance	Vdcw
CN35	3,000 mmf	800
	6,000 mmf	600
	10,000 mmf	400
CN36	3,000 mmf	400
	6,000 mmf	400
	10,000 mmf	300
CN40	3,000 mmf	400
	6,000 mmf	300
	10,000 mmf	300
CN41	3,000 mmf	600
	6,000 mmf	600
	10,000 mmf	400

The d-c working voltage of a capacitor can be determined from the above table when the case size and value of capacitance are known.

CAPACITORS

FIXED, CERAMIC-DIELECTRIC

CC	20	AH	100	G
COMPONENT	CASE	*CHARACTERISTIC	CAPACITANCE	*TOLERANCE

COMPONENT: CC signifies *fixed, ceramic-dielectric capacitor.*

CASE: Same as for fixed, mica-dielectric capacitors.

CAPACITANCE: Same as for fixed, molded, paper-dielectric capacitors.

NOTE: All fixed, ceramic-dielectric capacitors have a working voltage of 500 volts, d-c.

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*Items starred are of interest primarily to depot and higher echelon repair personnel.

†This is not a JAN specification. These capacitors are covered by AWS C75/221.

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Figure 24—Continued.

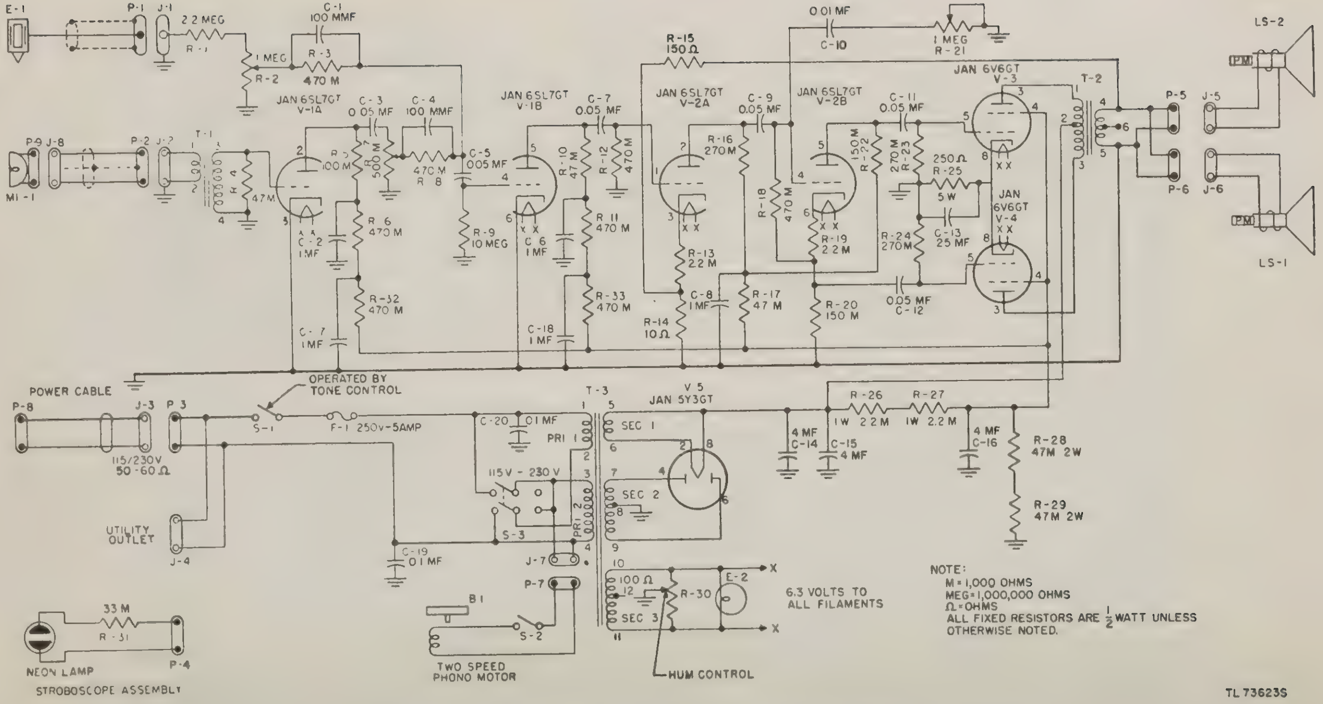

Figure 25. Reproducing Equipment MC–364–D, schematic diagram.

APPENDIX I

REFERENCES

Note. For availability of items listed, check FM 21–6 and WD Supply Catalog SIG 1 & 2. Also see latest issue of FM 21–6 for applicable Technical Bulletins, Supply Bulletins, Modification Work Orders, and changes.

1. Publications

a. SUPPLY.

SIG 1 & 2	Introduction and Index.
SIG 3	List of Items for Troop Issue.
SIG 4–1	Allowances of Expendable Supplies for Tactical Organizations.
SIG 4–2	Allowances of Expendable Supplies for Tactical Organizations, Training Centers, Boards, and Fixed Installations.
SIG 5	Stock List of All Items.
SB 11–17	Electron Tube Supply and Reference Data.

b. PAINTING AND PRESERVING.

SB 11–76	Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.

c. TECHNICAL.

FM 21–6	List and Index of War Department Publications.
TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 66	Winter Maintenance of Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TM 1–455	Electrical Fundamentals.
TM 11–453	Shop Work.
TM 11–462	Signal Corps Reference Data.
TM 38–650	Basic Maintenance Manual.

d. FORMS.

WD AGO Form 468	Unsatisfactory Equipment Report.
AAF Form 54	Unsatisfactory Report.

2. Abbreviations

A	adjust.
a-c	alternating-current (adj).
ac	alternating current (n).
B	high voltage for plate and screen circuits.
B—	B minus (low side of plate supply voltage).
C	clean.
contd	continued.
cps	cycles per second.
db	decibel.
d-c	direct-current (adj).
dc	direct current (n).
F	feel.
GL	grease, lubricating, special.
hy	henry.
I	inspect.
in.	inch.
kc	kilocycle.
L	lubricate.
lb	pound.
M	1,000 ohms.
meg	megohm (1,000,000 ohms).
mf	microfarad.
MFP	moistureproofing and fungiproofing.
mmf	micromicrofarad.
PM	preventive maintenance.
PS	oil, lubricating, preservative, special.
R	resistor.
rpm	revolutions per minute.
SD	dry-cleaning solvent.
T	tighten.
V	volt.

APPENDIX II

IDENTIFICATION TABLE OF REPLACEABLE PARTS

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1. War Department Supply Catalogs

The following information was compiled on 26 June 1947. The appropriate pamphlet of the War Department Supply Catalog for Reproducing Equipment MC–364–D is:

Organizational and Higher Echelon Spare Parts

SIG 7 & 8 – MC–364–D (when published)

For an index of available catalog, see the latest issue of War Department Supply Catalog SIG 1 & 2.

2. Identification Table of Replaceable Parts for Reproducing Equipment MC–364–D

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
	REPRODUCING EQUIPMENT MC–364–D: electromechanical; uses 10″, 12″ or 16″ diam disk; w/self contained 10 w amplifier; portable; 33⅓ or 78 rpm; amplifier unit 19″ lg x 19⅜″ wd x 11″ h over-all; speaker unit 13⅞″ lg x 14½″ h over-all; 115 v or 220 v ac, 50 to 60 cycle single ph 88 w; table type; plywood base, olive drab.		6C264D
O3	ARM: phonograph; aluminum; 12″ x 1″ wd x 13/16″ h over-all Astatic No. 400.	Retains reproducer head.	6C174–2
E3	BOARD, terminal: 12 brass silver pl term. lugs; bakelite; 4″ lg x 2⅜″ wd x ⅛″ thk; Espey part/dwg No. EA26.246.	Mounting board for resistors.	3Z12531–43
E2	BOARD, terminal: 30 brass silver pl term. lugs; bakelite 8½″ lg x 2⅜″ wd x ⅛″ thk; Espey part/dwg No. EA26.245.	Mounting board for resistors and capacitors.	3Z12531–43.1
	CABLE, power: Sig C Cordage CO–144; Underwriters type S; two #18 AWG cond ea comprising 41 #34 AWG strands; RC; ¼″ OD; Sig C spec No. 71–684.	Cordage for cable assemblies.	3E2144
	CABLE, special purpose: Sig C Cordage CO–119; two #20 AWG stranded cond; color-coded black and white; RC; round 0.280″ OD; Sig C spec No. 71–1105.	Cordage for microphone cord.	3E2119

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
W4	CABLE ASSEMBLY, power: two cond type SJ #18 AWG stranded; 300 v working, round 0.305" diam; 25 ft lg excluding term.; w/Hubbell male plug No. 7057 one end, Hubbell female plug No. 7084 other end; Espey part/dwg No. AA13.017–1.	Connects amplifier-turn-table unit to source of power.	3E7350.1–300
W5	CABLE ASSEMBLY, special purpose: two cond type SJ #18 AWG stranded, 41 strands #34 AWG, rubber-insulated, color-coded black and white, 300 v working, round 0.305" diam; 25 ft lg excluding term.; w/Belden male plug No. H–1047 one end, ½" stripped and ⅜" tinned other end; Espey part/dwg No. AA13.017–2.	Used to connect microphone to MIC input on control panel.	3E7350–1.300
W1, W2	CABLE ASSEMBLY, special purpose: two cond, type SJ #18 AWG stranded, 41 strands #34 AWG, rubber-insulated, color-coded black and white, 300 v working, round 0.305" diam; 50 ft lg excluding term.; w/Amphenol female plug No. AN–3106–10SL–4S one end, 2½" leads w/½" stripped and tinned other end; Espey part/dwg. No. WA10.061.	Connects loudspeaker cables to SPEAKER input connectors on control panel.	3E7350–1.600
C1, C4	CAPACITOR, fixed: ceramic; 100 mmf ± 10%; 500 vdcw; 0.812" lg x 0.250" diam; JAN type CC26SL101K.	Bypass capacitor	3D9100–204
C10	CAPACITOR, fixed: paper; 10,000 mmf ± 20%; 600 vdcw; 1⅛" lg x 7/16" diam; JAN type CP26A1EF103M.	High-frequency cut-off resistor	3DA10–388

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C3, C7, C9, C11, C12	CAPACITOR, fixed: paper; 50,000 mmf ± 20%; 600 vdcw; 1½″ lg x ⅝″ diam; JAN type CP26A1EF503M.	Coupling capacitor	3DA50–292
C5	CAPACITOR, fixed: paper; 50,000 mmf ± 20%; 600 vdew; 1½″ lg x ⅝″ diam; includes mtg bracket; JAN type CP29A1EF503M.	Coupling capacitor	3DA50–259
C2, C6, C8, C17, C18	CAPACITOR, fixed: paper; 1 mf + 20% −10%; 600 vdcw; 2¾″ lg x $1\frac{3}{16}$″ wd x $\frac{49}{64}$″ thk; two solder lub term. on bottom of case; JAN type CP65B1EF105V.	Filter capacitor (d-c plate voltage)	3DB1–145
C14, C15, C16	CAPACITOR, fixed: paper; 4 mf ± 10%; 600 vdcw; herm sealed case; 5¼″ lg x 1½″ diam; two solder lug term. on bottom of case; JAN type CP40C2EF405K.	Filter capacitors, power supply	3DB4–259
C13	CAPACITOR, fixed: electrolytic; 25 mf; 50 vdcw; $1\frac{13}{16}$″ lg x 1″ wd x $\frac{15}{16}$″ thk; rectangular metal case; two solder lug term.; JAN type CE64C250G.	Bypass capacitor	3DB25–82
	CLAMP: cable; aluminum; two bolts used; 1″ lg x $\frac{25}{32}$″ diam; accommodates ⅜″ diam cable; Amphenol No. AN–3057–4.	Clamps cable in position	2Z2636–4
H3	CLIP: spring steel; $\frac{13}{16}$″ diam x 0.025″ thk; Genindco No. 19084.	Holds turntable in place during transit.	6C269/C2

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
J3	CONNECTOR, plug: two rectangular female parallel cont; T slots, straight; 1.906″ lg x 1.531″ diam, incl cable clamp; 15 amp, 125 v, 10 amp 250 v; Hubbell No. 7084.	Provides connection for power cable to power receeptacle on control panel.	6Z3150–5
J5, J6	CONNECTOR, plug: two round female cont; straight; $1\frac{5}{16}$″ lg x $\frac{25}{32}$″ diam over-all; Amphenol No. AN–3106–10SL–4S.	Provides connection for speaker cables to speaker input connectors on control panel.	2Z8672.46
J8	CONNECTOR, plug: two round female cont; straight; $1\frac{3}{8}$″ lg x 0.525″ diam over-all; Espey No. PA32.094–2.	Provides connection for microphone cord to microphone.	2Z8672.27
P4	CONNECTOR, plug: two rectangular male cont; straight; $1\frac{5}{8}$″ lg x 1″ wd x $\frac{5}{8}$″ thk; 15 amp 125 v; Gen Cement No. 865.	Provides connection for neon lamp cord to UTILITY OUTLET.	6Z3148–1
P7	CONNECTOR, plug: two rectangular male cont; straight; $1\frac{3}{4}$″ lg x 1″ diam over-all; 15 amp, 125 v; Belden No. H1047.	Provides connection for phono motor cable to power.	6Z7591–7.1
P8	CONNECTOR, plug: two rectangular male cont; straight; 1.842″ lg x 1.531″ diam over-all; 15 amp, 125 v; Hubbell No. 7057.	Provides connection for power cable to power source.	6Z1727
P1	CONNECTOR, plug: one round male cont; straight; $\frac{15}{16}$″ lg x $\frac{11}{32}$″ diam over-all; Cinch No. M95.	Provides connection for pick-up cable to amplifier circuit.	2Z3021–163
P2	CONNECTOR, plug: two round male cont; straight; $1\frac{3}{8}$″ lg x 0.525″ diam over-all; Epsey No. PA32.094–1.	Provides connection for microphone cable to MIC INPUT.	2Z7112.21

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
J1	CONNECTOR, receptacle: one round female cont; straight; $1\frac{5}{16}$" diam x ½" thk; Gen Cement No. 1743.	Accommodates connector on pick-up cable.	2Z3063–117
J4, J7	CONNECTOR, receptacle: two round twistlock female cont; straight; 1.39" diam x 1.125" thk; 15 amp, 125v; Hubbell No. 9213.	J4 accommodates connector on neon lamp test cable. J7 accommodates connector on phono motor cable.	6Z7815
P3	CONNECTOR, receptacle: two flat tandem male cont; straight; $2\frac{5}{16}$" lg x 1¾" wd x 1⅛" d over-all; 10 amp, 250 v; 15 amp, 125 v; Hubbell No. 4897.	Power input connector on control panel.	6Z7816
P5, P6	CONNECTOR, receptacle: two round parallel male cont; straight; $2\frac{7}{32}$" lg x 1" wd x 1" h over-all; Amphenol No. AN–3102–10SL–4P.	Speaker input connectors on control panel.	2Z7112.27
W3	CORD, microphone: two #20 AWG stranded cond; 10 #30 AWG strands, rubber-insulated, color-coded red and black, 300 v working, tinned copper shielding over both cond, rubber outer jacket; 25 ft lg excluding term.; w/two cont male connector Espey part/dwg No. PA32.094–2 one end, other end two cont female connector Espey part/dwg No. PA32.094–1; Espey part/dwg No. WA–10.062.	Connects microphone to amplifier-turntable unit.	3E7400–300
H5	CORNER: speaker case reinforcement; corner shaped w/ea face a quarter circle; steel; 1½" lg x 1½" wd x 1½" h over-all; Corbin No. 3725X.	Reinforces speaker case	6Z3385–2
O4	DISK, stroboscope; used to calibrate turntable speed; cardboard; 6¼" diam x 0.040" thk; Franklin Photo Indus No. F–25.	Used to adjust turntable speed	6C15–1

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
H4	FASTENER: latch; cabinet; steel; 1⅜″ lg x ⅞″ wd x ⅞″ thk over-all; Corbin No. 15797.	Fastens case	6Z3810–27
F1	FUSE, cartridge: 5 amp; 250 v.; one time; glass body; ferrule term.; 1¼″ lg x ¼″ diam; Bussman No. 3AG5.	Protects local circuit from overloading damage.	3Z2605.2
H13	HANDLE: case; steel; 3″ lg x 4″ wd x ½″ thk; Stanley No. 1207.		6Z5010–7
E1	HEAD, reproducer: electrical; crystal type, 5 meg, impedance; 2 5/16″ lg x 1 1/16″ wd x ⅜″ h over-all; cut-off frequency 4000 cycles two ⅛″ mtg holes on ½″ mtg/c; two pin term, from rear; Astatic type No. L74.	Converts mechanical energy to electrical energy.	6C26–18
H9	HINGE: butt; steel; ¾″ lg x ⅝″ wd x ⅛″ thk over-all; Espey part/dwg No. A35.245.		6Z5075–27
H8	HINGE: slip; steel; 1 3/16″ lg x 1⅜″ wd x ¼″ thk over-all; Espey part/dwg No. HA35.188.		6Z5075–28
H15	HINGE: slip; steel; 2½″ lg x 1¾″ wd x ¼″ h over-all; Stanley No. 802.		6Z5075–1
H1	HOLDER, fuse: extractor post type; for single 3AG cartridge fuse; black bakelite body; 15 amp, 250 v; 1⅝″ lg x 1 1/16″ diam over-all; two solder lug term; Bussman No. HKM.	Holds fuse securely in position	3Z2880–2
O6	KNOB: bar; bakelite; for ¼″ diam shaft; single No. 8–32 setscrew; 1¼″ lg x ⅝″ wd x ⅝″ h; ½″ depth of shaft hole; Kurtz Kasch No. S292–1L.		2Z5848

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
E2	LAMP LM–52: 6–8 v, 0.150 amp; bulb T–3–¼ clear; 1⅛″ lg over-all; bayonet base; tungston filament; GE No. 47.	Serves as power pilot lamp to indicate power is on.	2Z5952
E3	LAMP LM–54: glow; 102–125 v; 65 v ac or 90 v dc striking; bulb T–2 clear; $1\frac{1}{16}''$ lg x ¼″ diam; unbased; neon gas; GE No. NE–2.	Part of stroboscope assembly; used to adjust turntable speed.	2Z5954
I1	LIGHT, indicator: w/lens; ½″ diam, red glazed lens; for bayonet base T–3–¼ lamp; open frame; cadmium pl, steel shell; $1\frac{3}{16}''$ lg x ⅞″ diam over-all; Drake No. 20.	Serves to mount and hold lamp LM–52.	2Z5991–4
	LIGHT, test: consists of 20″ lg type SJ two cond #18 AWG stranded cable w/GE No. NE2 lamp one end, Gen Cement male plug No. 865 other end and one JAN type RC10BF333K resistor housed in black bakelite case; 20″ lg less term.; Espey dwg No. WA 10.063.	Used with stroboscope disk to calibrate turntable speed for 33⅓ or 78 rpm at 50 or 60 cycles.	6Z6902
M1–1	MICROPHONE, dynamic: low impedance for 30 to 50 ohm circuits; $4\frac{3}{16}''$ lg x $2\frac{1}{16}''$ diam over-all; Amer Micro No. D4.	Converts sound energy to electrical energy.	2B1701
B1	MOTOR. AC: induction type, squirrel cage; $\frac{1}{20}$ hp, 33⅓ and 78 rpm; closed frame; pulley not included, plain shaft; $8\frac{5}{64}''$ lg x $5\frac{11}{16}''$ wd x $3\frac{7}{16}''$ h over-all shaft, ⅜″ diam protruding $3\frac{7}{16}''$ from frame; 110 v ac, 50- to 60-cycle single ph; Genindco type 46500 model No. 2DG4.	Supplies power to drive the turntable.	3H3000A05–37

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
O2	NEEDLE, reproducer: Steel point; straight brass shank; Fidelitone No. H14142.	Transmits lateral movement to crystal holder.	6C97–3
	NEON LAMP CABLE ASSEMBLY: (see LIGHT, test).		
N2	PLATE, indicator; speed regulation w/spaced graduations from F to S; steel; curved; 3⅞″ lg x 1″ wd x 0.050″ thk over-all; Genindco No. 4079.	Indicates turntable speed from F to S.	6C177–1
N1	PLATE, indicator: speed selection for 33⅓ or 78 rpm; steel; curved; 2¼″ lg x 9/16″ wd x 0.050″ thk over-all; Genindco No. 4797.	Indicates 33⅓ rpm and 78 rpm positions on deck panel.	6C177
H1	POINTER, indicator: steel; 3⅝″ lg x ⅜″ wd x ¾″ h over-all; Genindco No. 4093.	Used as lever to select 33⅓ or 78 rpm speed.	6C178–1
H2	POINTER, indicator: steel; 5⅝″ lg x ⅜″ wd x ¾″ h over-all; Genindco No. 9281.	Used as lever and indicator to select speed position on deck panel.	6C178
R14	RESISTOR, fixed: composition; 10 ohms ± 10%; ½ w; max body dimen 0.468″ lg x 0.249″ diam; JAN type RC20BF100K.	Inverse feedback voltage-dividing resistor.	3RC20BF100K
R15	RESISTOR, fixed: composition; 150 ohms ± 10%; ½ w; max body dimen 0.468″ lg x 0.249″ diam; JAN type RC20BF151K.	Used as limiting resistor in inverse feedback circuit.	3RC20BF151K
R25	RESISTOR, fixed: wire-wound; 250 ohms ± 5%; 5 w; max body dimen 1⅜″ lg x ⅝″ diam; power type axial tab term. 9/16″ lg x 5/32″ wd; JAN type RW50J251.	Cathode bias resistor for tube V3___	3RW20711.

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R13, R19	RESISTOR, fixed: composition; 2,200 ohms ± 10%; ½ w; max body dimen 0.468" lg x 0.249" diam; JAN type RC20BF222K.	Cathode bias resistor (R13) for V2A; cathode bias resistor (R19) for V2B.	3RC20BF222K
R26, R27	RESISTOR, fixed: composition; 2,200 ohms ± 10%; 1 w; max body dimen 0.750" lg x 0.280" diam; JAN type RC30BF222K.	Filter resistors for power supply	3RC30BF222K
R31	RESISTOR, fixed: composition; 33,000 ohms ± 10%; ¼ w; max body dimen 0.406" lg x 0.170" diam; JAN type RC10BF333K.	Load resistor, part of stroboscope assembly.	3RC10BF333K
R4, R10, R17	RESISTOR, fixed: composition; 47,000 ohms ± 10%; ½ w; max body dimen 0.468" lg x 0.249" diam; JAN type RC20BF473K.	Impedance matching resistor (R4); plate resistor (R10); filter resistor (R17).	3RC20BF473K
R28, R29	RESISTOR, fixed: composition; 47,000 ohms ± 10%; 2 w; max body dimen 1.41" lg x 0.405" diam; JAN type RC40BF473K.	Serve as bleeder resistors for power supply.	3RC40BF473K
R5	RESISTOR, fixed; composition; 100,000 ohms ± 10%; ½ w; max body dimen 0.468" lg x 0.249" diam; JAN type RC20BF104K.	Plate resistor	3RC20BF104K
R20, R22	RESISTOR, fixed: composition; 150,000 ohms ± 10%; ½ w; max body dimen 0.468" lg x 0.249" diam; JAN type RC20BF154K.	Plate resistor	3RC20BF154K
R16, R23, R24	RESISTOR, fixed: composition; 270,000 ohms ± 10%; ½ w; max body dimen 0.468" lg x 0.249" diam; JAN type RC20BF274K.	Plate resistor (R16); grid resistors (R23, R24).	3RC20BF274K

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R3, R6, R8, R11, R12, R18, R32, R33	RESISTOR, fixed: composition; 470,000 ohms ± 10%; ½ w; max body dimen 0.468″ lg x 0.249″ diam; JAN type RC20BF474K.	Grid and filter resistors	3RC20BF474K
R1	RESISTOR, fixed: composition; 2.2 meg ± 5%; ½ w; max body dimen 0.468″ lg x 0.249″ diam; JAN type RC20BF205J.	Load resistor, prevents overloading grid of V1B.	3RC20BF225J
R9	RESISTOR, fixed: composition; 10 meg ± 10%; ½ w; max body dimen 0.468″ lg x 0.249″ diam; JAN type RC20BF106K.	Grid leak resistor	3RC20BF106K
R30	RESISTOR, variable (potentiometer): composition; 100 ohms ± 10%; 2.25 w; three solder lug term.; inclosed metal case 1 1/16″ diam x 9/16″ d; round metal shaft slotted ¼″ diam x ⅛″ lg; linear taper; ⅜″ –32 x ⅜″ lg bushing; AB No. JLU1011.	Serves as hum control	3Z7100–32
R7	RESISTOR, variable (potentiometer): composition; ½ meg ± 20%; ½ w; three solder lug term.; inclosed metal case, 1¼″ diam x 9/16 d; round metal shaft ¼″ diam x ⅜″ lg; C taper; ⅜″ –32 x ⅜″ lg bushing; IRC No. 9301–17123.	Serves as MIC GAIN control	3Z7498–50.69

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R2	RESISTOR, variable (potentiometer): composition; 1 meg ± 20%; ½ w; three solder lug term.; inclosed metal case 1¼″ diam x 0.9″ d; round metal shaft ¼″ diam x ⅜″ lg; C taper; ⅜″ —32 x ⅜″ lg bushing; IRC No. 9301–17124.	Serves as PHONO GAIN control	3Z7499–1.68
R21 with SW1	RESISTOR, variable (potentiometer): composition; 1 meg ± 20%; ½ w; three solder lug term.; inclosed metal case 1¼″ diam x 27/32″ d; round metal shaft ¼″ diam x ⅜″ lg; C taper; ⅜″ —32 x ⅜″ lg bushing; SPST sw 3 amp, 125 v, normally open, operates at start of rotation, two solder lug term.; IRC No. 9302–17125.	Serves as TONE POWER-OFF control (power switch).	3Z7499–1.67
S4	SOCKET, tube: octal; eight cont medium; one piece saddle mtg; round mica-filled bakelite casting 1 3/16″ diam x ½″ h excluding term.; phosphor-bronze silver pl cont; Cinch No. 9663.		2Z8678.121
LS1	SPEAKER, dynamic: 10″ diam cone; PM field; input 6 w; voice coil impedance 3.5 ohms; 10⅛″ diam x 4¼″ h over-all; GE No. 1000C.	Converts electrical energy to sound energy.	6C35–26
H7	STRAP, carrying: cotton webbing; 7″ lg x 1½″ wd x 1½″ thk; both ends terminated in nickel pl steel rigid eye, snap catches 2 1/16″ lg x 1¾″ wd; North & Judd No. 340.	Provides handle for carrying loudspeaker case.	6Z8496–3

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
H6	STRAP, retaining: cotton webbing; 10″ lg x ¾″ wd x ⅛″ thk; w/one end terminated in steel tip ⅝″ lg x ¾″ wd steel buckle 1″ lg x 1″ wd other end; North & Judd No. 635.	Secures cords and cables securely in rear cover of loudspeaker case.	6Z8472–13
S3	SWITCH, toggle: DPST; 25 amp 125 v ac, 9 amp 250 v ac; bakelite body; $2\frac{7}{32}$″ lg x $1\frac{21}{64}$″ wd x $\frac{49}{64}$″ thk over-all; bat type handle $\frac{11}{16}$″ lg; solder lug term.; JAN type ST52K.	Serves as voltage selector (115 v or 230 v) switch.	3Z9863–52K
S2	SWITCH, toggle: SPST; 15 amp 125 v ac, 6 amp 250 v ac; bakelite body; $2\frac{7}{32}$″ lg x $1\frac{9}{64}$″ wd x $\frac{41}{64}$″ thk over-all; bat type handle $\frac{11}{16}$ lg; binding screw term.; JAN type ST42A.	Serves as MOTOR ON-OFF switch.	3Z9863–42A
T1	TRANSFORMER, AF: microphone input type; pri 50 ohms, secd 50,000 ohms impedance; herm sealed metal case, numetal core; $1\frac{9}{16}$″ diam x 2¼″ h less term.; turns ratio of pri to secd 1:31; freq response 70 to 9,000 cycles ± 1 db; four ceramic neoprene compression type term. at bottom of case; UTC part No. B–5153.	Couples microphone to pre-amplifier V1A.	2Z9631.326
T2	TRANSFORMER, AF: plate coupling type; pri, CT 8,000 ohms, secd CT 3.4 ohms impedance; herm sealed metal case, steel core; $2\frac{9}{16}$″ diam x 3¼″ h less term.; turns ratio of pri to secd 100:1.1; freq response 70 to 9,000 cycles ± 2 db; 12 ceramic neoprene compression type; term. at bottom of case; UTC part No. B–5154.	Couples output of power amplifier to loudspeaker.	2Z9632.454

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
T3	TRANSFORMER, power: filament and plate type; two windings 115 v 60 cycles ea winding single ph, parallel connection for 115 v series connection for 230 v input; three output windings; secd No. 1; 5 v at 2 amps; secd No. 2 630 v at 85 ma dc CT, secd No. 3 6.3 v at 2 amp; herm sealed metal case; $3\frac{23}{32}$" diam x 4½" h less term.; six ceramic neoprene compression type term. at bottom of case; UTC part No. B–5152.	Supplies plate and filament current for V5, and filament current for V1, V2, V3, V4, and for power pilot lamp.	2Z9608–74
V5	TUBE, electron: JAN–5Y3GT/G.	Furnishes d-c plate and screen current.	2J5Y3GT/G
V1, V2	Tube, electron: JAN–6SL7GT.	Preamplifier and first voltage amplifier (V1); second voltage amplifier and phase inverter (V2).	2J6SL7GT
V3, V4	TUBE, electron: JAN 6V6GTY.	Power amplifiers	2J6V6GTY
O1	TURNTABLE, reproducer: steel, brown top, flocked; 12" diam x 1" thk over-all; Genindco No. 22129.	Supports and rotates the record	6C460–3
H10	WASHER, flat: soft rubber, black; round; 1⅛" diam x $\frac{3}{32}$" thk; Espey part/dwg No. 27.898A.	Absorbs motor vibration	6L54005–5
H11	WASHER, thrust: rests on key in motor shaft and drive; steel; 1⅛" diam x $\frac{1}{16}$" thk; Espey part/dwg No. 27.899A.	Takes up thrust of turntable spindle.	6L75053

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